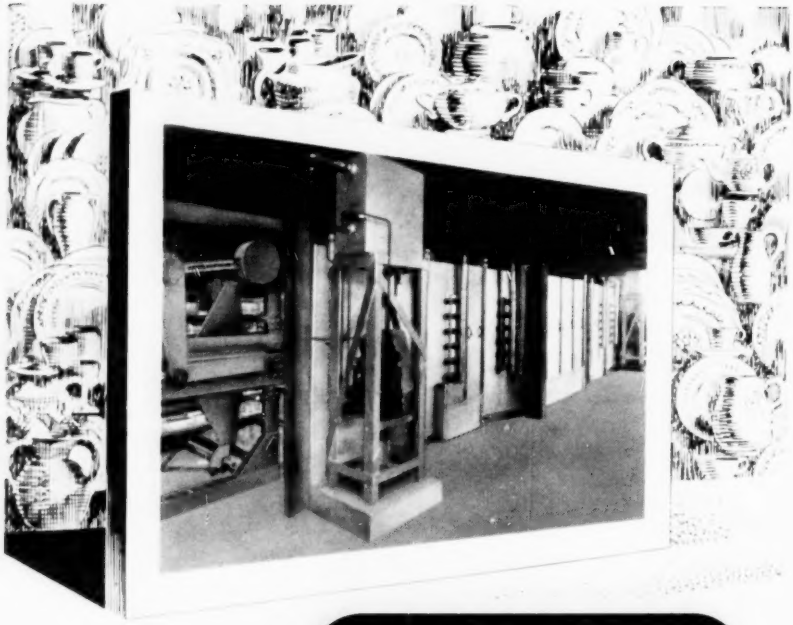
CERAMICS

FEBRUARY
1953

No. 48 Vol. IV

LONDON



GIBBONS

GOTTIGNIES
PASSAGE KILNS

(Illustrated above)

GIBBONS-GOTTIGNIES Multi-Passage Kiln
38' 6" long.

Duty:—Biscuit and Glost Wall Tiles

Fuel:—Electricity.

Installed at:—The Diamond Tile Company Limited, Hanley.

GIBBONS BROTHERS LTD. DIBDALE WORKS · DUDLEY · WORCS.

Telephone: DUDLEY 3141

EDITORIAL DIRECTOR:
DR. W. F. COXON,
M.Sc., F.R.I.C., M.Inst.F.

CERAMICS

FEBRUARY 1953

A monthly journal covering the whole ceramic field including pottery, glass, heavy clay, refractory and silicate industries.

Published Monthly
by
ARROW PRESS LTD.,
157 Hagden Lane,
Watford, Herts

Price 2/6d. per copy.
25/- per year, payable in advance.

FEATURE ARTICLES

MISCELLANEOUS

Copy and Blocks should be available to us by 14th of the preceding month.

They should be sent to:

CERAMICS
157 Hagden Lane, Watford, Herts
Telephone: Gadebrook 2308/9

Ceramics

VOL. IV FEBRUARY, 1953 NO. 48

CORONATION SOUVENIRS

by **ARGUS**

ONCE again there seems to be some disrespectful comment addressed to the pottery industry on the quality of its wares! The various remarks seem to warrant the same kind of comment which occurred round and about the time of the Festival of Britain. On that occasion I wrote:

"The Council of Industrial Design have for quite a while had the audacity to tell pottery manufacturers of note precisely that which they ought to design—of course at the expense of the manufacturer! Recently I had the opportunity of going round the factory of one of the well-known names in the fine china industry. Somewhat jokingly they showed me their exhibit for the Festival of Britain which had been accepted. The joke was that they had designed a piece of ware which they thought would be accepted by the Council itself. In forecasting the taste of the Council they had been successful for the exhibit was chosen, but they hastened to add that it would never see the light of day in production, because in their opinion it was not that which their overseas markets wanted!

"This is the sort of thing one gets when an outside body like the Council of Industrial Design thrusts itself upon a trade. Pottery exports—and the fine china exports in particular—go up and up due solely to the tradition, background and overseas contacts of the industry itself, although they are compelled to waste their time in making exhibits they will never produce simply to satisfy the Council's cultural creed!"

Backing a Hunch

The point is that to ensure that they were represented at the Festival of Britain show pottery manufacturers often did produce a design which they thought would satisfy the Council, for then the Council were commanders-in-chief and could say yea or nay to the appearance of an exhibit. However, when it comes to Coronation souvenirs the Council of Industrial Design is not in this position and the manufacturer of pottery can decide whether or not he should set

out to please the prospective customers he knows, or the Council according to the information available from the Council of Industrial Design only 40 per cent. of the designs for Coronation mugs have been approved by them, so maybe one can say that 60 per cent. of the manufacturers decided to back their own hunch, knowing their own customers, to produce something which they thought they could sell, but which the pundits of contemporary culture maybe thought was obnoxious.

Hardly Fair Comment

If one looks at the pages of one of our contemporaries describing and illustrating Coronation souvenirs by a variety of potters any overall criticism of the standard is absurd. For the noble Lord Drumlanrig to say at the recent Arts Council Forum, in so far as souvenirs and mugs were concerned, that "Everything was awful except Wedgwood, which was not too bad," was hardly fair comment, savoured rather of a subjective opinion and was so fantastic as to make it an absurdity. Potters are fighting an export battle and foreign competitors can use the noble Lord's words to operate against the pottery industry—a kind of commercial back-stabbing. Again the overseas potteries can sieze upon the fact that the Council of Industrial Design had only approved 40 per cent. of the designs submitted and it requires little exaggeration for this to be translated into a statement that only 40 per cent. of the British pottery industry's Coronation mugs and souvenirs are considered to be good workmanship'

Contemporary Design

Once more the positive danger of interference by external bodies like the Council of Industrial Design is realised. It is known, for example, that many in the Council of Industrial Design favour what are described as contemporary design which, after all, is only a subjective group opinion. Many of the potters believe that their traditional designs can still sell and indeed their post-war sales results tend to confirm this. On questions of design, music, playwriting—or, if you like, the arts—many people speak with authority, but because the question of likes and dislikes is entirely personal and entirely subjective anyone's opinion is as good as anyone else's'

A Question of Commerce

Making pottery is 99 per cent. commercial'

The potter is not in the fortunate position of a Government department—the latter can, at the ratepayers' expense, set about the problem of cultural uplift. The monopolists spending from the public purse have an opportunity of presenting their culture free, gratis and for nothing. The fact that such a department produces a glossy magazine or series of high-fallutin' lectures which run at a loss means nothing. But the manufacturer of pottery has to produce pottery which he expects to sell, and it can be taken for granted that he has studied the requirements of potential buyers. He knows what will and will not "click," for if he does not sell what he makes he goes broke!

One regrets that this sordid question of commerce must be dragged into what began as a very highly cultural discussion—but more than anything Britain needs overseas currency and for derogatory statements to be bandied about on the products Britain hopes to sell, based not upon fact but upon mere subjective opinion, is dangerous in the extreme.

One must ask one or two pertinent questions—do we accept that British pottery is at least as good as most countries and, in fact, better than many? It is not a question of complacency. Sales on the overseas market confirm this impression. There is thus some factual proof that the potter is able to produce the design and quality required by his overseas customers—that these designs might not be liked by a number of individuals is relatively unimportant. Since his overseas sales have confirmed his ability to forecast the market requirements is there any reason to assume that he cannot do likewise for the Coronation souvenirs'

The biggest problem facing the potter is not his design and quality he has established his ability in those fields—his major problem is one of giving this design and quality at a lower price, and that brings in the earthy engineer, with mechanisation

BORAX AND LEAD FRITS
OF ALL KINDS

ALL TYPES OF GLAZES FOR THE
CERAMIC TRADE

TRADE GRINDERS AND SUPPLIERS
OF ORES, MINERALS AND FILLERS, etc.

WET AND DRY GRINDING OF MATERIALS
UNDERTAKEN

SUPPLIERS OF ALL MATERIALS FOR THE CERAMIC
AND ALLIED TRADES

on the pottery floor, new methods, new techniques. In this useful field those with the above cultural proclivities are useless! It is so much easier to talk airily about opinions, but so much more difficult to translate an idea into a practical and commercial proposition.

It is overlooked by so many who comment like the noble Lord, that everything he had seen was "awful," except Wedgwood. As far as the Coronation is concerned it is a national occasion, and this nation consists of a variety of income groups from the high to the low. Yet the loyalty of a subject is not directly proportional to his or her pocket. In fact, in times of emergency it is the lower income groups who are called upon in the greatest numbers to do the greatest task. It does not need any cultural body like the Council of Industrial Design to tell the householder with a limited purse that he would like a piece of china or porcelain bearing the insignia of a well-known fine china manufacturer on its base. The B.B.C., the television, the newspapers and the cinemas have made names like Wedgwood, Minton, Worcester, Crown Derby, Shelley and so on every-day expressions. The humblest home knows of them!

But it is the same old story of the average motorist who appreciates the performance of a Rolls Royce or a Bentley, but contents himself with a Ford! The vast majority of the Coronation mugs and souvenirs are going to be sold to the lower income groups—they, in turn, are going to bring in the greatest revenue for the pottery manufacturers and, in turn, for the Chancellor of the Exchequer. The high-class market, important as it is, is not the major money-spinner, and it ill behoves those who can afford the best to be derogatory about the products which the vast majority will be compelled to buy because of a limited purse. It is shocking Victorian snobbery! It reminds one of a hymn now removed from the church hymnbook: "The rich man in his castle, the poor man at his gate, God made the high and lowly each to his own estate." It makes good communists!

It is bad enough when this kind of thought is portrayed in the political arena, but when it is reproduced in a cultural discussion it is a standing condemnation of the utterer. Potters make pots! Pots earn revenue for the nation! Potters can sell pots! Potters can design to sell! If the potters had proved that they could not sell their designs maybe the long-haired boys would have some edge on their critical blade, but as it is their blade is blunted. Potters know they must reduce their price and maintain the quality—the days of cheap labour are past, and therefore they can only mechanise more.

Of far more importance than this verbal battle involving the Council of Industrial Design is the millions of pounds which have been invested in the potteries to help in this process of getting a better quality price factor for British pottery. The example portrayed in the current issue of "Ceramics" dealing with the new factory at the Spode Works of W. T. Copeland and Sons Ltd., is a case in point.

"SOME MISTAKE"

MR. SEICHIRO NAGAI, chairman of the Japanese Chinaware and Porcelain Exporters' Association said on the 20th February, 1953, that Japanese pottery manufacturers want to meet their British counterparts to discuss the alleged unauthorised use of British designs in Japan.

He went on to say that there had been "some mistake" on the part of British china and porcelain makers over the use of designs by Japanese manufacturers. In the post-war confusion small and medium-sized Japanese companies had produced goods bearing designs similar to British makers, but they did so on the instruction of foreign buyers.

ZIRCON SAND

IN the January, 1953 issue of Ceramics, Mr. B. L. Majumder contributed a short note on "Indian Zircon," in which the chemical analysis of two Travancore samples were compared with one pure Australian variety, by F. W. Berk and Co., which Company have written to say that the chemical analysis of Zircon Sand as now supplied by them is as follows:

SiO_2	32.74
ZrO_2	66.78
TiO_2	0.08
Al_2O_3 etc.	0.20
Fe_2O_3	0.02
MnO_2	0.01

Thermal Conductivity and Insulation

SPECIALLY CONTRIBUTED

THERMAL conductivity is an important property, since its magnitude controls the rate at which heat can be transferred into, and lost from ovens, furnaces, steam pipes, etc. In choosing insulating materials we have to bear in mind the temperature at which they are expected to operate, and the value of the thermal conductivity. If the refractoriness under load is satisfactory, then, in general, the material with the lowest thermal conductivity will be most suitable for insulation.

Definition of Thermal Conductivity

In thermal conduction heat is transmitted from particle to particle, and the amount conducted is given by the formula:

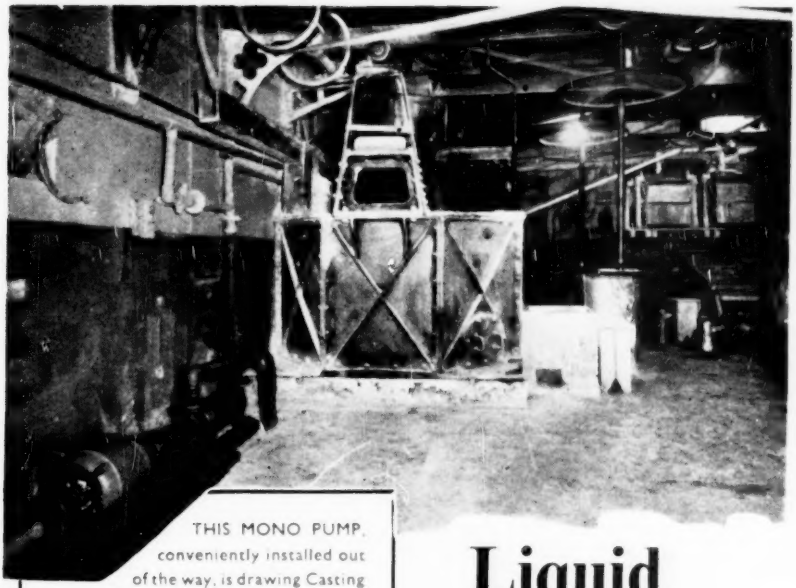
$$H = \frac{k.a.\theta.t}{l}$$

where H is the quantity of heat transmitted in time t through a substance whose area of cross section is a, and whose thickness is l, when the difference in temperature between the hot and cold faces is θ°. k is a constant for the particular material over the given temperature range, and is called the thermal conductivity. When the quantities involved are H B.T.Us, a sq. ft., °F., t hours and l inches the conductivity is expressed as B.T.U.

TABLE I.

Material	*Temp. C*	*Thermal Conductivity B.T.U. sq.ft hr. inch/1 F.*	*Max Safe Temperature for use C*
85 per cent. magnesia	38	0·4	315
	93	0·44	
	150	0·49	
	205	0·55	
	260	0·61	
	315	0·68	
Low temp. diatomite slabs (as mined)	300	0·55	900
	400	0·58	
	450	0·61	
Solid grade do. bricks	300	1·19	851
	400	1·22	
	450	1·25	
Light grade do.	400	0·84	850
	450	0·88	
	500	0·92	
Low temp. (asbestos)	300	0·64	900
	400	0·68	
	500	0·72	
Intermediate temp. (diatomite base)	350	1·13	1100
	400	1·17	
	500	1·23	
High temp. porous fireclay	300	1·58	
	400	1·66	1400 C.
	500	1·78	
Vermiculite bricks	200	1·04	1100 C.
	600	1·48	
Vermiculite concrete (Cement fondu)	78-667	1·97	1200

Other grades operate up to 800 F.



THIS MONO PUMP, conveniently installed out of the way, is drawing Casting Slip 12 feet from an underground reservoir and pumping to the magnetic sifter.

Liquid Abrasion?

The abrasive content of Casting Slip, Flint or Stone Slop or Glaze can take heavy toll from pumping equipment. The unique principle of the Mono Pump providing a rolling motion between rotor and stator, together with the low and uniform velocity of flow, contribute towards a considerable resistance to wear from abrasive compositions. There are no valves. On filtration duties this steady flow produces a firm and consistent cake and can improve the quality of slip.

Operating delivery on gland there is a complete absence of aeration when pumping to the casting shop.

Add to these advantages, self priming, easy maintenance, space saving and lack of noise when operating and it is clear why so many Ceramic Engineers choose the Mono Pump.

The MONO pump

MONO PUMPS LIMITED

MONO HOUSE, 67 CLERKENWELL ROAD, LONDON, E.C.1

Tel: Holborn 3712 (6 lines) Cables: Monopumps, London Code: A.B.C. 7th Edition

and at Birmingham, Dublin, Glasgow, Manchester, Newcastle, Wakefield

MP195dm

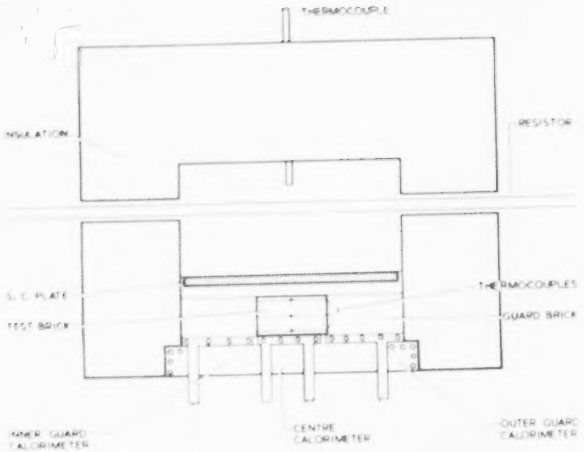


Fig. 1

sq. ft. °F. in. hr., and there are corresponding values for the constant when metric system units are employed.

Values for the thermal conductivities of some insulating materials are given in Table I. They are taken (in part) from F. A. Gray, R. J. Sargant, and H. H. Utley (Fuel Econ. Rev., **21**, 34, 1942).

Experimental Determination

A method for the determination of thermal conductivity is described in A.S.T.M. C. 182-43T. 1943 (Amer. Soc. Testing Materials, Philadelphia Pa.) and the essential details are sketched in Fig. 1. It consists of a means of heating the specimen and measuring the flow of heat across it by a water-cooled calorimeter on which it rests.

Three 9-in. bricks are selected, free from broken ends, etc. One is placed on the metal surface of the central calorimeter through which water flows at a known speed. The temperatures of the ingoing and outgoing water are measured, and from this the quantity of heat transmitted by the specimen in a given time can be calculated. The other bricks are placed similarly on calorimeters on either side of the test brick to act as guards and to prevent side flow of heat. The specimen is thoroughly dried at 220–230° F. for 12 hr., and holes are drilled in it on the 4½ in. side to take the thermocouples, which are located at the mid point and 0·02 in. below the hot face and 0·02 in. above the cold one. A silicon carbide bat covers the test and guard bricks and the whole is heated from above by a silicon carbide resistor. A structure of insulating brick covers the assembly.

In some other types of conduction apparatus the heating elements are of metal, located beneath the specimen, and the water calorimeter is placed over it. (cf. L. R. Barrett, F. H. Clews and A. T. Green (Trans Brit. Ceram. Soc., **42**, 220, 1942). Before taking readings the furnace must be allowed to reach a steady state. This may require several hours. When this is reached the temperature difference between the brick faces is measured on the thermocouples, and heat transfer in a given time calculated from the flow of water in the calorimeters and the rise in temperature. The area of cross section of the test piece at the point where the thermocouples are embedded is obtained by sectioning it and measuring the dimensions. Thermal conductivity is then calculated from the expression:

$$k = \frac{H\,l}{\theta\,t\,a}$$

where θ is the temperature difference between the hot and cold faces as measured by the thermocouples, t is the time, a is the area of the central calorimeter on which the brick rests, H is the quantity of heat flowing into the calorimeter and l is the thickness

between the thermojunctions. Usually in this country k is measured in B.T.U./sq. ft./° F./in./hr. Various precautions have to be taken to ensure an accurate result and for these the reader is referred to the original papers.

Classification of Insulating Materials

Values of thermal conductivity show great variations as between metals and non-metals. At ordinary temperatures we have:

Iron	416
Copper	2500
Firebrick	10
Silica brick	12
Sillimanite	12
Ballast concrete	6
Building brick	6
Insulating brick	0·6-2·0

It is evident that insulating brick and insulating material generally has a very much lower thermal conductivity than other common building materials. Its use may therefore, be expected to effect savings in fuel. This is shown by many examples in scientific literature and some examples will be quoted later. Not all heat losses are due to conduction—convection and radiation also play a part, but insulation also reduces these by lowering the temperature of the exposed surface.

Insulating materials are usually grouped into low, medium, and high temperature types. In the low grade we have materials like felt, straw, glass wool, slag wool, and some kinds of magnesia-asbestos compositions. These are useful for lagging steam pipes, boilers, etc. In addition there are various grades of material based on diatomite, whose limiting temperature is 800 -900° C. In the medium temperature range we have certain other types of diatomite brick, as well as vermiculite. For high temperatures lightweight firebricks are used.

Air a Good Insulator

It is very apparent that great use is made of air cells in insulating materials. Thus diatomite is composed of the shells of minute marine creatures called diatoms. When viewed under a microscope these are seen to be full of minute pores containing air. Again enfoliated vermiculite and expanded perlite are full of air pores produced by heating the minerals so that gas is liberated, which bloats the substance to many times its original volume. Such material is then a poor heat conductor.

Pumice, clinker, foamed slag, and expanded clay have similar structures, and are used particularly in insulating concrete. Lightweight fireclay bricks are made by mixing sawdust with the plastic clay. After shaping, the bricks are dried and fired. The sawdust then burns out, leaving a lightweight brick full of pores. The air in these reduces the thermal conductivity of the material. Such bricks are easily cut, and are usually trimmed to shape on an abrasive wheel after firing.

Insulating Concrete

Insulating concrete is now widely used in buildings as well as on ovens and kilns. The aggregate for this is a material of low bulk density with a highly porous structure. Molten blast furnace slag when treated with limited amounts of water can be expanded by the steam produced to form what is called foamed slag. Similarly certain types of shales and clays, when heated to the point where they begin to soften can be bloated by gas evolution. This material is very popular in America as a lightweight aggregate, but is not made to any great extent yet in this country.

An extremely light material, enfoliated vermiculite, made by heating the material rapidly to between 650° and 1,000° C. is being increasingly used here in plaster and concrete to provide heat and sound insulation. Pumice, after grading and washing, is also used, though it is heavier than some of the other materials. A material now attracting attention is perlite. This is a glassy volcanic rock, which is converted to a light expanded material by rapid heating and gives a very light material. At the moment perlite is imported into this country, though there are deposits in N. Ireland.

The properties of these materials are given in Building Research Station Digest No. 32, July 1951, and some of the properties are given in Table 2.

Mention should be made of aerated concrete in which the presence of air cells is used to reduce conductivity. These are usually made by the addition of a chemical such as aluminium powder to generate gas bubbles in the concrete before it sets, or alternately the mixing water is foamed by addition of a foaming agent before being added to the cement aggregate. The thermal conductivity varies with the density of the set concrete, and is about 0·75 for material weighing 30 lb./c ft., and 2·3 when the density is 90 lb./c. ft. Intermediate densities give approx. proportional conductivities.

Insulation of Kilns

Intermittent kilns should be insulated in such a way that as little heat as possible passes into the kiln. This results in quick heating up and cooling down, and, in so far as there is less heat to be dissipated from the structure, means less heat lost.

In former days attempts at insulation were confined to putting insulat-

TABLE 2

Aggregate	*Density lb./c.ft.*	*Mixture*	*Thermal cond. of concrete in B.T.U./in./ft.²/hr./° F.*
Pumice	30-55	1:6 or more	About 1·4
Clinker	45-65	do.	2·8-4·0
Foamed slag	30-50	1:6 or 1:12	1·5-3·0
Expanded clay	35-65	do.	2·3-3·2
Expanded vermiculite	4-12	1:3 to 1:9	1·0-1·9
Expanded perlite	5-12	do.	0·75-1·5

TABLE 3

KILNS BURNING BRICKS

A = *hot face insulated* *B* = *corresponding values with ordinary firebrick.*

Contents	A	B	A	B	A	B	A	B	A	B
	21,500 R.W.C.		*21,100 R.W.C. & pressed*		*56,600 6" × 6" × 1" quarries & 6,500 R.W.C.*		*11,000 R.W.C. & terra cotta*		*Brown terra cotta*	
TIMES										
Airing (hr.)	34	46	36	47	41	50	48	48	42	42
Burning („)	62	61	54	63	72	76	60	70	60	73
Cooling („)	72	66	70	68	80	82	70	72	66	75
TOTAL („)	168	173	160	178	193	208	178	190	168	190
Time saved („)	5	—	18	—	15	—	12	—	22	—
FUEL (total tons)	13.4		13.13		16.4		14.1		12.7	
Firebrick lined kiln		17.6		17.19		19.2		17.2		17.7
Average fuel thousand bricks (cwt.)	13		13¼		16¼		12½		12½	
Tons fuel saved per burning	4.1		4.3		3.4		3.05		5	

ing brick or powder on the outside of the kiln. This was necessary because insulating materials that would stand the temperatures of the inner faces of the walls had not been developed. The result was slow cooling, and the period in which the kiln could be turned around was lengthened, thus to some extent off-setting the advantages of insulation. With the introduction of hot face insulation as it was called, these disadvantages were overcome.

With continuous ovens the necessity for hot face insulation is not so important, since the kiln does not have to be heated each day. Here it may suffice to put the insulation on the outside.

Economics of Insulation

The economies effected by thermal insulation have been stressed in numerous published papers and catalogues. In this article the examples chosen relate mainly to the ceramic industries and concern boilers and kilns. Thus H. V. Allen (Trans. Brit. Ceram. Soc., **35**, 437, 1936) gives examples of the economies effected by hot face insulation on intermittent kilns firing red clay ware and firebricks. The results are given in Tables 3 and 4.

The lower thermal capacity of insulating materials as compared with firebrick also gives quicker heating up from cold. This is important in annealing furnaces, etc., which are worked intermittently. Much thinner walls are also permissible provided the mechanical strength is adequate. Messrs. T. Marshall and Co. (Loxley) Ltd. near Sheffield give a very good example of this in their catalogue. Illustrations are given showing the temperature gradient in walls operating at 1,200° C. inside, and at about 100° C. outside made in the one case of 18 in. firebrick, 4½ in. diatomite and 4½ in. of building brick, and in the other of only 9 in. of their Hyfer insulating brick backed with 4½ in. building brick (Fig. 2).

The same author gives an example of the savings in running an intermittent annealing furnace at 750° C. (Table 5).

Steam Pipe Insulation

The economies attending lagging of steam pipes and boilers are well illustrated by the Darlington Insulation

TABLE 4

FIREBRICK

Kiln	*Not insulated*	*Outside insulation*	*Hot face dome & part of side*	*Hot face insulation throughout*
Size	17'	17'	17'	20' 6"
Load (3 in. bricks)	16,000	16,000	16,000	23,500
Weight (tons)	64	64	64	94
Total time firing & cooling (hr.)	192	202	170	171
Coal used (tons)	14	13	11	11
Coal saved per cent.		7·14	21·4	46·5
Coal/ton ware burnt (cwts.)	4·37	4·06	3·44	2·34

TABLE 5

	Not insulated	*Insulated*
(*A*) *Heating up to* 750° *C.*		
Time (hr.)	4	1
Gas/hr. (c. ft.)	1,000-1,200	700-800
Total gas/week (c. ft.)	27,000	4,500
Saving (c. ft.)		22,500 or 83%
Maintaining at 750° *C.*		
Gas/hr. (c. ft.)	750	350
Gas/week (c. ft.)	33,000	15,400
Saving (c. ft.)		17,600 or 53·3%
Total consumption per week (c. ft.)	60,000	19,900
Saving	Approx. 66%	

TABLE 6

Example	*Automatic Coal-fired Lancashire boiler installation*	*High-pressure water-tube boiler Installation*
Boiler efficiency	72%	87%
Fuel cost/ton	55/7	55/7
Calorific value (B.T.U./lb.)	12,000	12,000
Av. temp. exposed surfaces to be insulated	350° F.	Sat. steam 450° F. Superheated steam 850° F.
Calc. total heat less from bare surfaces (B.T.U.) per annum of 300 days of 24 hr.	5,092,000,000	68,448,900,000
Heat conserved by Darlington Insulation per annum as above (B.T.U.)	4,752,000,000	65,795,340,000
Value of heat saved/annum	£682	£7,816/10/0
Total cost of insulation	£143/10/0	£988
Annual return on outlay	475%	791%

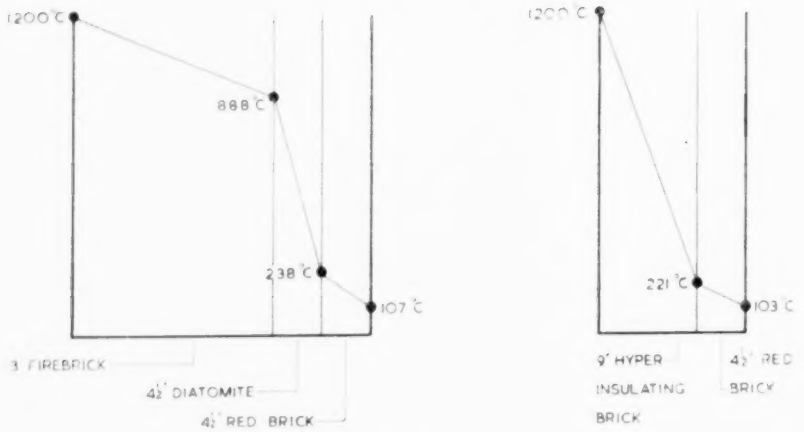


Fig. 2

Co. Ltd., Newcastle-on-Tyne in their brochure on the uses of magnesia and similar laggings which is reproduced in Table 6 by permission of the company.

It is thus apparent that the cost of insulation can be recovered in a very short time. As the prices of fuels continue to rise the returns on money invested in this way continue to appreciate. Moreover the conserving of national resources makes efficient thermal insulation more and more an obligation on the community.

ROYAL DOULTON POTTERIES

UNDER the above title there has appeared an excellent publication dealing with the history of the House of Doulton beginning in 1815, in Vauxhall Walk, Lambeth. The pottery is linked with early days going back indirectly to the reign of Elizabeth I. The story of the development through the centuries is traced with some excellent illustrations of contemporary work at different stages. There are biographical notes on personalities now famous John Doulton, 1793-1873, the founder; Henry Doulton; Henry Lewis Doulton, and Lewis John Eric Hooper, the present Chairman.

There is an excellent description of how pottery is made, its manufacturing stages, and then some beautifully coloured representations of the work of the Royal Doulton Potteries.

On a utilitarian basis, mention is given of the various stoneware jars, filters and absorption towers used extensively in the chemical industry, as well as examples of electrical porcelain and heavy clay products.

The book concludes:

"Ceramics is a fascinating craft. It is so much a part of today, so much a part of history, too. Between the pottery of early civilisations and modern twentieth century ceramics, stretches an unbroken strand of craftsmanship; more, perhaps, than most men, the potter has always received an abiding satisfaction and pleasure from his work. We hope that something of this spirit has been evoked in the pages you have just read; they are evidence that, in pride of work as well as in quality, the potter in this country is maintaining the high traditions that have built up a world-wide demand for English ceramics."

View of the factory with new buildings on the right

Extensions to the Spode Copeland Factory

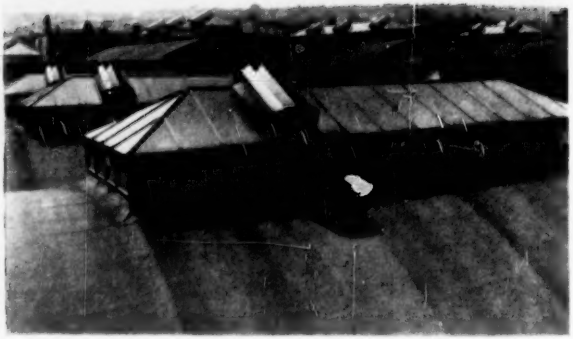
SPECIALLY CONTRIBUTED

It is said that the township of Stoke-on-Trent grew up around the factory of Spode. Certainly before Spode's time there existed the firm of Turner and Banks whose factory was on the site of the present Spode Copeland factory. In 1762 Spode managed this factory until in 1770 it was sold to him by Banks, and from that date onwards it has continued to develop and expand on the original site.

In the early days a great deal of skill and energy was given to the developing of the science of potting both by Spode and his successors. In latter years the firm has concentrated and continue to concentrate its efforts towards developing both the plant and the layout of the factory with a view to obtaining the highest possible quality and the most efficient flow of production.

The modern development began in the early 1930's with the addition of electric kilns and a gas glost oven necessitating the rebuilding of sections of the factory to fit in with these innovations. The war called a halt to development, but in 1948 planning commenced for the rebuilding of the major part of the earthenware section of the factory, and as this is now in production, some details of the scheme may be of interest.

Right from the start a small Planning Committee under the chairmanship of Mr. R. Spencer Copeland was formed. Each member of this Committee investigated one or more angles of the proposed schemes with the aid of the departmental managers concerned, and put before the full Committee his suggested details of work to be done, layout, quotations and specifications. The Committee having vetted these then passed them



Roof construction and ventilators

Courtesy, Colt Ventilation Ltd.

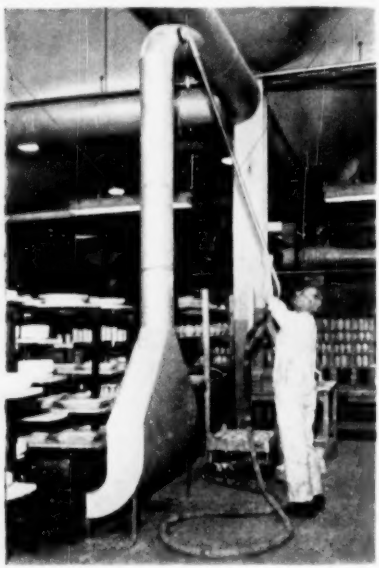
on to the board of directors for final approval.

The site chosen was that occupied by Spode's original making shops and drying kilns, being known as the Black Bank, for it was here that Spode made his Black Basalt, and it also incorporated the land through which the old canal bringing supplies to the factory used to flow.

The contract for the building was placed with Messrs. Cornes Ltd. in March, 1950, Messrs. Hind and Brown of Hanley being the architects responsible.

Briefly, the new building was to house all the earthenware flat and cup-making section, together with cup cellar, turners, handlers and towers, etc., also a greenhouse, twin tunnel ovens, biscuit warehouse and printing shop.

The type of construction chosen is a new one to the pottery industry consisting of reinforced concrete barrel-vaulted roofs carried on pillars and the whole being constructed on a beam foundation supported by pressure-driven piles, the latter being necessary as the site of the old canal and its environs were not solid. Over 300 of these piles were sunk to a depth of approximately 20 ft. resting on solid clay. The barrel-vaulted roof is constructed of steel bar and fabric reinforcement round which concrete was cast to a thickness of approximately 3 in. Aluminium lantern lights are suspended from the top of each barrel and the outside of the roof is finished with a layer of cork insulation and a double layer of roofing felt. The inside had sprayed on to it a layer of asbestos cement with a colour spray finish, the entire roof being carried on reinforced concrete stanchions which make it entirely independent of the walls. Both the wall glazing and the lantern lights are of aluminium which is considered to reduce maintenance to a



Cleaning duct work by vacuum system

Courtesy, British Vacuum Cleaner and Engineering Co. Ltd.

Section of clayware greenhouse

Stillards for flat and holloware in receive for printed ware

minimum as no painting is required. The glazing along the front of the building consists of reinforced concrete frames set in to the brick wall. Between the building and Kingsway the land has been laid out as an attractive garden.

Granolithic hard-wearing type of floors have been laid in all departments except the biscuit warehouse, and here the floor is of pitch mastic as this was considered less likely to cause breakages due to ware being set down upon it. The type used was of a special type to leave no mark on the ware after firing.

Great care was taken in the ventilation under the scheme, the whole being devised to give adequate ventilation and change of air in both summer and winter. It consists of an assisted natural type ventilation using controlled inlets along the walls and a patent type of roof ventilation set in the lantern lights to extract the air.

The warehouse and the printing shop are steam heated by radiators and the making department is mainly heated by unit heaters. The greenhouse is heated by waste heat from the tunnels which is piped in ducts to a plenum plant where it can be filtered and adjusted for volume before passing to the individual discharge points.

The lighting system has been arranged to give a high value of illumination, the average for the printing department and on the work benches being 30-ft. candles, while the general level of illumination in the biscuit warehouse is 20-ft. candles. In the making department which has individual lighting on the benches there is a level of illumination of 30-ft. candles. It is interesting to note that the installation required over nine miles of electric cables and over three miles of galvanized conduit.

A vacuum cleaning system is installed whereby a large mobile unit is housed in an outbuilding and connected by means of ducts to a variety of points throughout the scheme, it being merely necessary to connect the hose and cleaning tools required to any of the static points which are so placed to enable the whole area of flooring to be cleaned quickly and efficiently.

The making department, which together with the clay stores, mould stocks and the cup cellars covers over 1,000 sq. yards is divided into two

Trucks waiting to enter biscuit tunnel kiln

sections by steel and glass partitions with slide doors, one section being the cup shop and the other being the flat shop. Four mangle-type dryers are in use in the cup shop which also contains cup turning machines, scalloping machines, handle-cutting machines, etc.

In the flat making shop provision was made for eleven new dryers, there being four cabinet-type dryers for saucers and small flat, two cabinet-type dryers for 7 in. and 8 in. flat and two for 10 in. flat, and three dual-chamber dryers of a new design for drying the more difficult 10 in. shapes. In this department new jiggers and spreaders have been installed and six new towing machines complete with dust extractors are sited between two parallel rows of dryers, the makers being on the outside of each row.

Over the whole layout great care was taken to ensure that ware should move easily from one end to the other, and to carry this out with the minimum amount of handling movable metal stillards were put into use, each able to carry twelve 4 ft. 6 in. boards which slide into angled arms, the whole being moved by jack-lift trucks. The lowering mechanism of these trucks was made to give a very slow rate of travel when used with clay ware so that the stillards make contact with the floor with the minimum of jolt. The extra time taken is well worth the saving in loss due to broken or strained ware.

As each stillard from the cup or flat making department is filled it moves to the trackway at the head of the shop which connects directly to the greenhouse, passing by a small partitioned counter's office. These stillards then stand in lines directly adjacent to the biscuit placing position and can be removed by jack-lift direct as required to the placing benches.

The two twin biscuit tunnel ovens are fully muffled gas-fired kilns. They are 126 ft. long with an outside width of 10 ft. in the fire zone and a maximum height of 8 ft. 6 in. The trucks are 4 ft. 5 in. long, 1 ft. 8 in. wide and the placing height is 2 ft. 9 in., there being twenty-six trucks in each

2

refractories which may well change the

✻ THE MORGAN M.R.1

A brick that carries the ordinary high quality firebrick into entirely new fields of usefulness. It can be used, for example, at temperatures as high as 1900°C—far beyond the capacity of other refractories of similar alumina content: up to this temperature after-contraction is negligible. The strength and resistance to abrasion are unusually high. With these bricks, the conventional standard of comparison—alumina content—is no longer valid. They can be judged only on performance, and in performance they are comparable only with special purpose refractories having a very high alumina content indeed.

How is it done? The answer is in the way they are made: in the selection and purification of the clay; in the unusually hard burning and careful grading of the grog; above all in the very high temperature of the final firing. The manufacturing process is a continuous one—which in itself makes for uniformity—and it is carried out under rigorous quality control. All this costs money—but bricks of this type, although not previously manufactured in this country or in Europe, have been in use for some years in the U.S.A. where they have decisively proved their economy in terms of reduced furnace maintenance.

TYPICAL PROPERTIES OF M.R.1

Approximate Chemical Analysis

Silica (SiO_2)	52.53%
Alumina (Al_2O_3)	43.44%
Iron Oxide	less than 1%
Other Impurities	3%

Physical Characteristics

Refractoriness	Cone 35 (1770°C)
Refractoriness under load (25 lb. sq. in.)	
Commencement of subsidence	1600°C
10% subsidence	1700°C
After-construction (2 hrs. 1600°C)	less than 1%

whole conception of furnace maintenance and efficiency

✻ THE MORGAN LOW STORAGE REFRACTORY M.I.28

—a brick that can double furnace output. It is a hot-face insulating refractory which can be used at furnace (or interface) temperatures up to 2800°F (1538°C).

At these temperatures it has a lower conductivity than any other type of refractory and therefore provides a greater reduction in the losses from the outside of the furnace. But that is less than half the story. The M.I.28 is only one third the weight of an ordinary refractory and consequently would require only a third of the heat to raise it to the same average temperature. But, with the same furnace temperature the average temperature of an M.I.28 is much lower (owing to its lower conductivity), and this still further reduces the amount of heat it takes up. With the same heat input, therefore, furnaces built from M.I.28 bricks heat up rapidly. On batch furnaces the bricks can double the furnace output—to say nothing of the saving in fuel.

There have been hot-face refractories before. What is new about the M.I.28, then? In theory nothing . . . but in manufacture Morgans have put the whole of the theory into practice. The bricks are made on entirely new plant with scrupulous attention to detail and rigorous quality control from the purification of the clay to the final grinding to size. As in the case of the M.R.1., bricks of this quality have been available for some years in the U.S.A., and the improvements they can make in furnace efficiency have been firmly established.

TYPICAL PROPERTIES OF M.I.28

Maximum Service Temperature	1538°C (2800°F)
Thermal Conductivity:	
Mean Temperature	
538°C (1000°F)	
	2.4 B.Th.U. hr (sq. ft. × (in. ÷ °F)
816°C (1500°F)	
	2.9 B.Th.U. hr (sq. ft. × (in. ÷ °F)
Bulk Density	47.5 lb. cu. ft.
Heat Capacity Factor	0.105
(the ratio of the heat stored in a M.I.28 furnace wall relative to that stored in a firebrick wall of the same area, and of a thickness giving similar hot and cold face temperatures)	

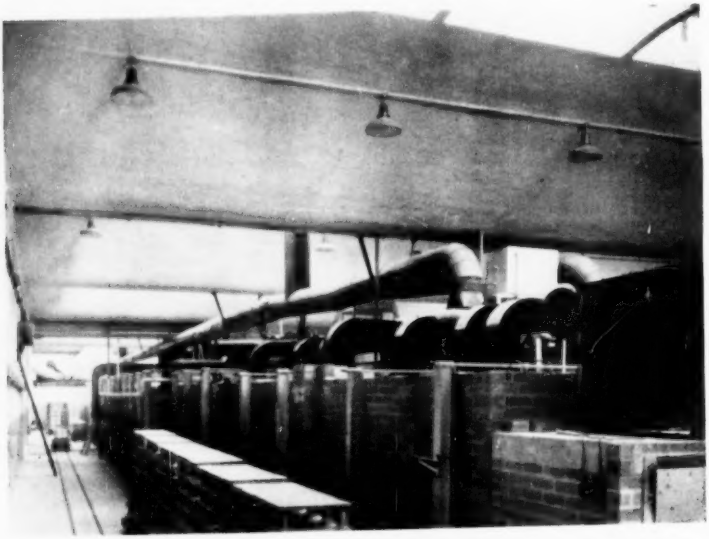
MORGAN Refractories ARE WORTH FAR MORE THAN THEY COST

THE MORGAN CRUCIBLE COMPANY LTD
Battersea Church Road, London, S.W.11.
Tel: Battersea 8822

kiln. Each kiln carries sixteen thermocouples, six of which are connected to a recording pyrometer, and twelve are connected via a multi-point switch to a direct reading pyrometer. The kilns were designed to give maximum flexibility for both temperature curve and control of atmosphere and have many safety devices including the ringing of a bell and the showing of a light if any one fan or motor should stop. The whole of the ware is placed open on a setting of sillimanite bats and posts surmounted by adjustable discs which rise or fall as they are turned to ensure getting contact at each point of suspension; these bats were originally ordered both 1 in. and ½ in. thick, but experience has shown that the ½ in. bats do not deform even when used with the heaviest loading of flat. The kilns, as well as firing the ware, act as a conveyor between the making department and the biscuit warehouse, the tracks from the tunnel oven being continued via a transfer carway right into the biscuit drawing section which is adjacent to the main biscuit storage and looking-over warehouse. Specially designed racks of aluminium alloy angle are in use in the warehouse into which slide boxes of cups to reduce storage space. Provision is made for each of the main shapes to be kept in separate blocks of shapes and sizes. At the far end of the warehouse provision is made for orders to be set out for the printing shop, and from this section the ware is loaded into trucks and taken by lift to the floor above which houses the new printing department.

The printing department contains 1,000 sq. yards of floor space as does the biscuit warehouse beneath it, and it has a 9 in. reinforced concrete floor supported on mushroom-type stanchions which pass through into the biscuit warehouse below. It also contains nearly 400 ft. of steel and glass partitioning as the normal flat press printing is carried on in cubicles each housing two teams.

In another section of the department, two moving belts are installed to carry ware to the automatic print pressing machines. At the head of one of these belts are situated two roller printing machines and individual transferrers tables are arranged



A view of one of the biscuit tunnel ovens

Printing shop showing arrangement of cutter and transferrer

on either side. The cutting of the prints is done on a revolving wheel with a perspex disc as the base on which prints are cut, and a glass cutter is used for cutting. The transferred ware is placed on the belt and removed for pressing down. Washing-off tubs are arranged by the print pressing machines for the removal of paper.

Stillards and jack-lifts are used throughout this department and the printed ware is removed to a receive immediately adjacent to the washing-off tubs.

The old printing shops have been transformed into additional painting shops by the use of partitions and these are immediately adjoining the receive for printed ware.

One of the main objects of this scheme is to ensure that the maximum amount of high-class decorated ware can be produced, and emphasis was laid throughout the plan on the production of quality rather than quantity, and only such mechanical aid as would enable quality to be maintained or improved were incorporated. Now the second move for developing the factory is under consideration and this criterion is again the focal point.

BRITISH COKING INDUSTRY ASSOCIATION

MR. G. E. HALL, M.Sc., A.R.I.C., has been appointed chief technical officer to the British Coking Industry Association. He has been connected with the coking industry since taking his degree in Gas Engineering at the University of Leeds in 1934, where he held the first Cartwright Holmes Scholarship in Gas Engineering.

He joined the coke oven erection department of Simon Carves, and later went to Dorman Long and Co. Ltd. He has served as a principal scientific officer with the British Coke Research Association, specialising in the problems of coal blending.

Since 1947 Mr. Hall has been senior technical officer on the planning staff of the National Coal Board's Carbonisation Department.

Depreciation and Maintenance of Pottery Manufacturing Equipment

5.—Physical Control of Loose Plant and Tools

by S. HOWARD WITHEY, F.Comm.A.

IN previous articles in this series it has been demonstrated that when the annual cost of maintaining manufacturing equipment in proper condition shows little variation, the most convenient method of computing and recording depreciation in the capital value of fixed assets is to write off an equal proportion of the first or original capital cost and charge this against the productive operations in such a way that at the end of the service or useful life of the equipment the balance shown in the books will represent a purely realisable or break-up value. If the equipment upkeep costs are expanding each year, or are likely to increase as time goes on, the combined charge for depreciation and maintenance can often be equalised by writing off a fixed percentage of each year's reduced book value, the progressive decline in the depreciation debit providing some or all of the margin needed to cover the expanding upkeep costs.

Revaluation

In many instances, however, it is difficult or impossible to arrive at reliable figures representing the value of loose plant and tools used in the processes of throwing, glazing, firing, and the making of crucibles, unless the equipment is subjected to a revaluation on the part of an expert potter or independent valuer of acknowledged reputation. When the revaluation method is applied, the amount by which the existing book value of the plant and tools exceeds the new valuation figure can be credited to the asset account and debited to the depreciation account, the final balance of which should appear as a charge against the profits.

Several advantages can be derived from a revaluation of assets on the part of an unbiased valuer. In addition to relieving directors and managers from the necessity and responsibility of certifying the figures, the fixing of independent sums is usually satisfactory alike to the proprietors, shareholders and auditors, and additional capital issues—whether in the form of shares or debentures—are materially facilitated by the production of a properly-signed certificate of value. Insurance claims are also likely to meet with a greater measure of success, and appeals against arbitrary or excessive tax assessments are usually more successful, while income-tax allowances are often granted without the customary questions being raised by the authorities. In the case of the partnership of two or more master potters, the deeds or other working agreements can be drawn up on a more solid foundation, and this, of course, is important, especially at the present time.

Information Required

It is now recognised that mechanisation in almost all sections of the pottery industry calls for the constant presentation of information and data revealing the manufacturing efficiency of the various types of machines, plant and tools, for while in theory each unit or group of equipment should operate at a hundred per cent. efficiency, this is not always achieved in practice. Such factors as a temporary shortage of clay, bricks, or other supplies; variations in the quality of essential materials or stores, mechanical breakdowns; inefficient standards for the inspection of kilns, air compressors, or finishing plant; the lack of proper supervision; and labour inefficiency

PLANT RECORD

Description
Location
Suitable for
Name of Manufacturer
Drive
Discharge
Estimated Service Life
Cost of Acquisition £
Attachments

No.

years. Annual Rate of Depreciation
Carriage Charges £
Cost of Installation £

Reverse Side of Card

REPAIRS AND ADJUSTMENTS

		Date	*Particulars*	*Cost*
Book Value as at	19			
Depreciation written off				
Reduced Value				
Capital Additions				
Book Value as at	19			
Depreciation written off				
Reduced Value				
Capital Additions				
Book Value as at	19			
Depreciation written off				
Reduced Value				
Capital Additions				
Book Value as at	19			
Depreciation written off				
Reduced Value				
Capital Additions				

and absenteeism, are some of the more common causes of a low percentage of manufacturing efficiency, and it is the duty of time study engineers to grapple with such problems. Decisions in regard to the acquisition and installation of new or additional machines and electric kilns, electrically operated potters' wheels, etc., are usually governed to some extent by the behaviour of the equipment previously employed and by the cost of repairs and maintenance involved in the various processes; consequently, it is a matter of very considerable importance that the records kept by pottery manufacturers should provide the amount and type of information required to facilitate such decisions, and that a suitable system of accounting and costing should be set up.

Group Similar Equipment

In order to be of any real practical utility to proprietors and executives, all productive and profit-earning equipment of the same type, or which is used for similar processes, should be grouped together for the purpose of internal check and control, and the data summarised to show at a glance the precise number of units of each class or description and any variations that may have taken place during a particular financial or operating period. In some cases it may be found that the number of units under a given heading is greater than is called for, having regard to the capacity of the kilns or the business as a whole; in other cases the records may show that output, turnover, or certain processes are being retarded by the continued use of inadequate equipment or by an insufficiency of the right types, and this would enable changes to be effected in good time, and the general level of productivity to be raised. By re-arranging certain machines and units of plant it is often possible to discard a number of loose tools and reduce costs, and to install the remainder to much better advantage, and recent experience has proved conclusively that when presses, mills, drying stoves, tanks, microscopes and units of laboratory equipment, etc., are subjected to a periodical physical control on the part of the management, much more satisfactory results can be obtained than

is possible when there is no systematic attempt to exercise a check over the equipment employed.

Plant and tool records not only simplify the computation of the balance of unrecovered investment and the amount to be written off and included in the costings under the heading of Depreciation, but are the means whereby claims and adjusted assessments can be supported, and there is now a definite trend towards the maintenance of detailed and elaborate records. These records usually take the form of cards which are suitably ruled and arranged in sequence to conform with the general filing system, sufficient space being reserved at the top of each card for the insertion of particulars such as the location of the plant, the constructor's name and number, the size or weight, etc., and provision may be made for showing the net invoiced cost of acquisition, the carriage charges, the cost of any attachments or gadgets, also the dates of assessments or periodical revaluations. Several styles of card are in use at the present time, one of the most satisfactory being shown on page 558.

As installation expenses are usually written off against profits on a basis different from that applied to the plant itself, it is usually advisable to record details of the cost instead of lumping the items together under one heading.

Another important factor to be considered in the computation and recording of depreciation in the capital value of pottery manufacturing equipment is interest on capital, and this will be discussed in the next article.

Revival of Dutch Glass Industry. The recession in the glass industry in the Netherlands, which was apparent in the earlier part of 1952, now seems to be giving way to better conditions. It is reported from Holland that unemployment in the Maastricht glass industry has now been reduced to practically nil and that at Leerdam and Tiel the glassworks there will be able to take on more workers in the fairly near future. A new oven is said to have been put into service at the Nieuw Buinen plant, which, in 1952, had to lay off 250 of its workers.

Developments in Pottery Engineering

by

J. A. JOHNSON

(Service Engineers Ltd.)

As this is my third bi-annual lecture to your Association on the same subject, namely, developments in pottery engineering, I have of necessity to deal with the developments between each lecture; also to deal with aspects of previous developments which have been overlooked or are not being given sufficient attention.

I propose, therefore, to deal with the developments and tendencies revealed during the last two years, and finally to examine in more detail present day methods of body preparation which I consider to be our greatest weakness in works' practice, or shall we say technique.

Some sections of the mechanical or plant side of our industry, such as milling, magneting and others, have recently been considered by your Association, and I shall but briefly mention the developments in such fields.

Raw Materials

As far as English pottery manufacture is concerned, that is from an engineering point of view, the main developments in the field of raw materials are:

(1) The making available of a certain quantity of dried graded clays which are suitable for dry-mixing, but as our milled materials are wet ground, it does not appear that dry-mixing, that is the mixing of all the body constituents in a dry form, tempering with slip, followed by pulverising for pressing or further mixing and de-airing for plastic making will be adopted in this country.

(2) We must not of course overlook the possibility of the prefired body, ground, mixed with thermo-setting organics, formed in hot presses, maturing and glazing with a very rapid fire, which may be in the region of two to three hours. Such a development is technically possible, but the economic side, which is in some doubt, has yet to be proved. If it is a cheaper form of production then it will demand a new engineering approach to our industry.

Milling

The continuous grinding process has continued to grow in popularity, not only on account of the reduced cost, but also because of the greater use of control. It may interest you to hear of the forms of continuous grinding cylinders that are available. Where batch grinding is desirable, there is a tendency to make the cylinders individually gear driven, saving space and giving ease of control.

The Tektor

A useful and inexpensive ancillary apparatus for use in the milling, and incidentally in many sections of our industry, including tiles and sanitary, is the Tektor, which consists of an electronic capacity relay, suitable for for mounting in almost any position, complete with a probe for introducing into a tank, bin, conveyor line or the like, an electrical field is set up about the probe and the approach or withdrawal of any mass or liquid in relation to the field causes a change in capacity, which in turn operates the unit. It is not necessary to establish

electrical contact with the medium: the change in capacity operates the relay, which can be connected to any circuit to ring bells, operate lights, or effect the control of the equipment feeding the container or conveyor. The sensitivity of the Tektor is easily adjusted to work either when in direct contact with the medium, or merely by its proximity. It appears to provide the solution to the majority of industrial level control problems. It is simple to fit and adjust, and does not rely on any mechanical device such as flap or diaphragm, and is suitable for materials which would adhere to a mechanical device, and put it out of action.

The Velofeeder

There is a further piece of ancillary plant, namely, the Velofeeder, the main advantages of which are:

(1) A precise and even flow, for by the mere turn of a handwheel which controls the amplitude of the vibration, the rate of feed can be precisely adjusted to any value from zero to a maximum rate which varies with the material handled. Once the control is set, there is no appreciable variation in the rate of feed.

(2) Reduced running costs. Because of the natural frequencies the two opposed sets of springs are designed so that an F.H.P. motor driven shaft which carries tiny out-of-balance weights is able to maintain the vibration, the power consumed is very small.

(3) Works quietly and high rate of feed. The opposite-phase action of the masses ensures that little or no vibration is transmitted to the frame, therefore the feeder is practically noiseless in operation. As the high amplitude of vibration is combined with a working frequency of 1,850 vibrations per minute, the high rate of flow can be maintained. Providing the material to be fed is not sticky, and of such size as can be handled by the machine, there seems to be very little limit to its scope.

Sliphouse or Body Preparation

There have been a number of developments in this section and whilst we will consider them in our general survey, we must return to this subject as I am convinced that this our most important department, for our body is the foundation on which all is built, and yet it is our weakest section.

Shredders

There have been several attempts to ease the heavy load of blunging ball clay, one such attempt being shredding of the clay before blunging; a machine has been developed in the U.S.A., simple in design and yet effective, it also has the advantage that it can be used as a conveyor whilst shredding.

Ball Mill for Ball Clay Blunging

Experiments have been carried out with a specially designed batch mill to blunge the ball or other strong clays, the blunging time being reduced from three to four hours down to thirty minutes. The slip, at this stage, should be sifted before passing on to the mixing.

Weight-Cum-Volume

Weight-Cum-Volume is the name given to the method of weighing and measuring the volume of every ounce and pint of the entire mix, and weighing and measuring accurately.

The main development in this method has been modifications that have made it possible to measure and weigh the complete mix and more accurate measurement of the volume. At last the value of this system is beginning to be realised.

Velosifter

Even the best of modern sifters sometimes give trouble by blinding when sifting slip, and pancaking or de-watering when dealing with milled material and glaze. The rapidity of the vibrations coupled with their small amplitude, appears to be the cause of these troubles.

The Velosifter operates at 1,400 vibrations per minute, and amplitude can be varied between 7/8 and zero, enabling the machine to be set to give the highest efficiency on slips, milled materials and glaze.

Drum Dryers

These dryers are being tried out in

several of our small tile works and for small quantities and if steam is available, are economic; if this method of de-watering slip is to be adopted, I think a modified finger type drum will give greater efficiency than the plain drum now being tried.

Hawk De-Airing Unit

The quality of the clay produced by the Hawk De-Airing Unit is beginning to be realised, and at the same time, the value of the mixer to which we shall refer later.

Making

High quality china flat ware is now being made on semi-automatic flat machines, using special making cams to allow for adequate lubrication while the piece is being made.

China Cups

Here again, the special cams have enabled high quality cups to be made on the double-head semi-automatic cup machine, and the nine foot high mangle type jet dryer gives cups ready for turning.

Roller Flat Ware Making Machine

As you are aware, intensive work is still being carried out on this process, the use of oil is no longer necessary, and the making rate for saucers has been increased to 15 per minute per making head per operative, with improved quality.

Fully Automatic Making

The fully automatic making based on the American principles is not proving suitable to our English requirements and conditions; it is not the cost of the machine and dryer, which can vary between £50,000 and £200,000, according to the number of making heads or stations, for very valiant attempts have been made in this country and all honour is due to the pioneers, nor is it the body, but apparently our body preparation.

Ram Process

The Ram process has continued to develop in U.S.A. and has proved itself as an economic unit for difficult and irregular shaped articles. Whilst flat ware and cups are being made by

this process, in my opinion it will not at any time replace jiggering.

The process consists of using plaster moulds or dies fixed in an hydraulic press to press the plastic clay to the required shape. As each die or mould makes 2,000 or more pieces before being replaced, the plaster has to be much harder than used for jiggering or casting, and yet has to be porous to absorb up to 3 per cent. sometimes 4 per cent. moisture from the clay. This has been cleverly obtained by inserting perforated copper pipe in the mould during casting.

For larger articles bats cut from the pug wad or slug are used. The moisture content of the clay must not vary more than plus or minus 2 per cent. and the weight of the clay fed to the die must be accurate if undue wear to the edge of the moulds is to be avoided.

A combined compressor and vacuum pump is required to give 60 c.f.m. at 125 lbs. per sq. in.

The clay is fed to the machine at 24 per cent. moisture content and is reduced to 20 per cent. during pressing at 400 lbs. per sq. in. Purging of the mould and sponging off is necessary every two or three pieces. Output varies according to the size of the article, but 10 in. square pieces are produced at the rate of 150 per hour.

Care is required in handling the pressed ware as it has no mould support as in jiggering, but the lower moisture content makes it quite handleable. Plaster bats or setters are required for larger pieces.

Machine with Multiple Die

Output of smaller pieces can be greatly increased by the use of the multiple dies.

The press operator must be a skilled worker, familar with the consistencies and other characteristics of clays. In this pressing operation, pressures are governed by the operator and must be varied to compensate for variations in the moisture content of the clay coming from the pug.

The ware does not need special drying. In some installations the method of drying varies from air-dried on portable stilliards to jet dryers. Ram pressed ware dries slightly slower than jigger or cast ware, due to the greater compaction of the pressed piece.

Drying

For semi-automatic making, the mangle type dryer with its annealing or maturing stage, followed by a medium and then more rapid stage, with final drying is still the most satisfactory system, providing that they are operated at the output for which they are designed.

Where head room is restricted the double run type, which is considerably shorter but embodies the same principles, can be used.

The dobbin jet type of dryer, which has recently been developed, with its various sizes of jets, is a cheaper type of dryer, with low steam consumption and even drying, but suffering from the defects of the dobbin dryer with regards to layout, feed and discharge.

Mangle Jet Type Cup Dryer

This dryer of small dimensions, and only 9ft. high, embodying variable jets, dries cups at the rate of up to 12 per min. ready for sponging, the spongers being able to withdraw their own cups without touching the mould.

Casting Plants

The main advance during the last few years in casting plants has been the continuous pumping of the slip, all surplus being returned direct to the efficiently agitated stock ark, and the pressure in the pipe line being kept up by a pre-loaded return valve. Providing the pipe line, pump installation, return valve and ark is correctly designed for the job, trouble through air in the slip, such as pin holding etc., is entirely eliminated.

Handle Casting Turntable

There has been a considerable increase in the use of these machines, the developments of the last two years have been largely mechanical, improved doors and duct design, with stronger fans and motors.

Heated handle dies have again come to the fore, but electrically heated for greater ease of control and clean atmosphere. The advantages of the plastic handles are too well known to need emphasising, including the fact that the handles are ready for sponging as soon as made.

The output per operative is approximately the same pressing and casting. Pressing 5,400 per day, casting 5,012 per day.

The 4-arm handling machine when fitted into a suitable production line, is still desirable for mass-production: the main development has been the fitting of a slip applicator.

A new development has been the single-head handling machine, based on the same principles as the four armed machine, but handling up to 10 or 12 cups per min. with the operator sponging after the application of the handle.

The main development in brushing is the horizontal roller brushing machine, with floating top brush, for flat ware including dishes, but excluding fruits and soups. The output is 2,000 dozens of 12 per dozen with one feeder, and one taker-off, who stacks the ware in trucks. It also gives facilities for back stamping on the conveyor, which is a great saving and advantage.

A printing machine has been developed to take all sizes of rollers from 2 in. to 6 in. in diameter, and from 2 in. to 14 in. long, with easy and quick changing.

The main development in decoration has been the B.C.R.A. flat lining and banding machine, which will apply 4 lines on any part of the face, and also edge line, the output being six to nine per min. per station with one operative working two stations.

Silk Screen Direct Printing

A further development in decoration is being tried out on the Continent, namely direct printing of ware by the silk screen process, but it is too early to give an opinion. However, I would say that similar machines were tried out in the U.S.A. prior to the war, but were found unsatisfactory, largely owing to the variation in size and crookedness of the ware, in fact during the period I had them under observation, they were standing far longer than they were running.

This variation in size and crookedness is one of the main obstacles to the mechanisation of decoration, and in flat ware would appear to be caused through variation in towing and bending in the bung during firing owing to variations in the body, strains in making and the reduction in weight on the piece, from piece to piece up the bung.

Mr. Johnson then discussed with

the aid of slides, the problem of ball clay variation, and concluded his address as follows:

There is one other line of thought I would like to leave with you, and that is this. As we now see more clearly the needs of our industry, and shall do so from day to day, and also the destructive tendencies of the world at large, and the apparent lack of purpose and aim in our lives, leaving everything as far as possible to the planners, I would remind you that each and every one of us add something to our industry, even when we are not intentionally doing so, we are often making a contribution to that great unwritten and unchartered tradition which governs our outlook, approach, and immediate actions even more so than research can do. It takes a long time for the knowledge gained by research to be applied, whilst tradition is ever with us, and even research is affected by outlook, tradition and accumulated knowledge.

Whilst this thought is an inspiring one, it is also an humbling one, for if our contributions are not sound, they hinder and hacken our industry instead of helping it forward.

Then again, if we make a helpful suggestion, whether it is a new formula, or design, or process, or apparatus, or a machine, let no-one think it is his own, for surely it is a result of all that has gone before, with our own added small contribution.

Mammoth Use of Refractory Materials

IN their dual role of iron and steel manufacturers and structural engineers both for domestic and overseas markets Dorman Long and Co. Ltd. depend on vast supplies of refractory materials of various kinds. Indeed, continuity of operations in a large integrated iron and steelworks of this magnitude is largely dependent on the quality of refractory materials used and the care which is taken of them. Each year Dorman Long spend over £1,000,000 under this heading during which period 14,000,000 refractory shapes are used in their works.

These include the silica linings of the coke ovens, the high grade firebricks and carbon bricks of the blast furnaces, the basic refractories for the steel furnaces and the linings of ladles to transport molten metal. These are all chosen with care, not only so that the various departments may carry on smoothly and efficiently, but for the sake of safety and the maintenance of high quality products.

In order to achieve a full overall picture of the refractories used by Dorman Long, to assess their quality and their suitability for different jobs, refractory supplies are periodically tested and comprehensive works trials are undertaken. Quality and behaviour of materials is closely watched and information obtained is regularly exchanged at meetings of the steel plant managers, the foreman bricklayers, the refractories engineer and technicians of the Central Research Department.

A portion of the requirements in firebricks for ladle linings and silica bricks for more arduous temperature conditions is made at Dorman Long's brickworks at Newfield, near Willington, County Durham. This works has a weekly output of 250 tons of firebrick products and 250 tons of silica products, all of which are consumed in the company's iron and steelworks operations. At the silica works at Newfield both round and Newcastle kilns are used while the continuous type kiln is used at the brickworks.

In addition to firebricks and silica products the company's requirements in basic refractories such as magnesite, chrome magnesite both fired and unfired are very large. The consumption of dead burnt dolomite, used for "fettling" the steel furnaces reaches 70,000 tons per annum.

Since the war Dorman Long have laid down plans for large scale developments and in the last six years substantial advances have been made. By the end of 1952 stage two of their development plan was approaching completion and a new large steel plant at Lackenby, as well as other plant, are expected to be in operation by the summer of 1953. Dominated by a huge melting shop 1,083 ft. long, 230 ft. wide and with a height of 128 ft., the Lackenby steelworks has been designed for an annual ingot production of 500,000 tons and is capable of convenient expansion to 750,000 tons. The task of finishing the installation of equipment, including the great 360-ton open hearth tilting steel furnaces, is now well in hand.

Stage three of the development plan will include new rolling mills at Lackenby.

COATED GLASS FABRICS

By

R. H. WARRING

WOVEN glass fabrics, impregnated and coated with polytetrafluoroethylene, combine an unusual set of physical properties of unique value to the electrical industry and for non-electrical applications where good mechanical strength is required over a wide range of temperatures, with good anti-adhesive or anti-friction properties and almost complete resistance to chemical attack. Chemical and solvent resistance is outstanding. The coating material, polytetrafluoroethylene, is impervious to attack by all normal chemicals, with the possible exception of fluorine. About the only substances which does attack the material is molten alkali metals. Even chemicals which normally attack glass have no action on coated glass fabrics impregnated and sealed with polytetrafluoroethylene, except possibly at cut edges where layers of the glass fabric may be exposed. As manufactured in tapes, cloths or sheet laminates, however, all the exposed surfaces consist of a homogeneous film of the inert polytetrafluoroethylene.

Both the fabrics and the sheet laminates possess excellent electrical insulation properties and may be used at continuous service temperatures as high as 500° F. For short periods, working temperatures can be even higher. At the same time the fabrics remain pliable down to temperatures of the order of minus 100° F.

Chief applications in electrical engineering would appear to be for armature wrappings, coil insulating sheet, phase separators, etc.; core and lead insulation; battery cases, separator plates, condensers and capacitators, etc. Many shaped components can be cold formed from the sheet laminates, whilst others of more complex form can be hot formed at a temperature in the region of 750° F. and a pressure of about 1,000 lb. per sq. in. The cloths and tapes, of course, are manufactured in "finished" form. Laminated sheets, of course, can be cut, drilled and worked with normal hand or machine tools, as in the production

GENERAL PROPERTIES—COATED SHEET (SINGLE PLY)

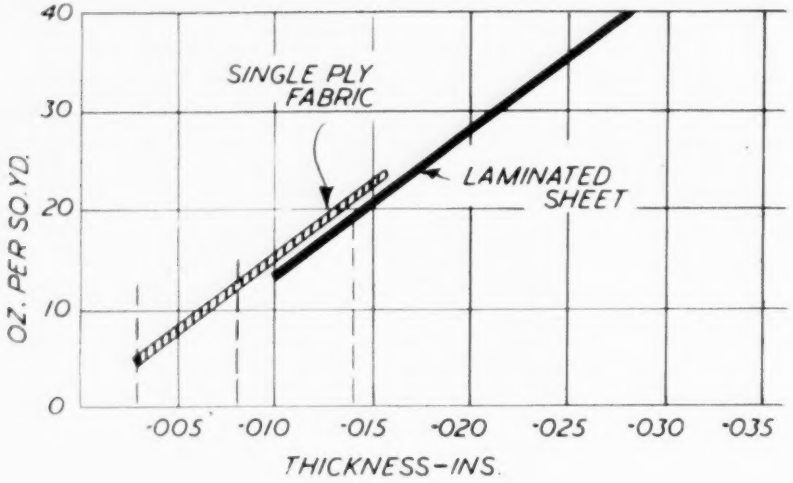
		Thickness (in.)				
		.003	.005	.008	.010	0.014
Tensile strength lb./in. width	warp	40	70	215	225	250
	weft	35	65	210	215	210
Tear strength lb./sq. in.	warp	720	750	1,200	—	—
	weft	500	750	1,360	—	—
Elongation		Nil	Nil	Nil	Nil	Nil
Shear strength lb./sq. in.		7,800	13,100	11,300	11,300	11,200
Stiffness lb./sq. in.	warp	—	—	130,000	132,000	168,000
	weft	—	—	—	97,000	113,000
Water absorption		0·30	0·26	0·30	—	—
Permeability 100 m. hr.		36	55	56	—	—

THERMAL PROPERTIES. COATED SHEET (SINGLE PLY)

	Thickness (in.)			
	.003	.005	.008	.010
Thermal conductivity B.Th.U./hr./° F./ sq. ft./in.	0·1245	0·1000	0·2680	—
Service temp. °F. (continuous)	460-480	480	480-500	480-500
maximum (intermittent)		600° approx. limit		
Brittle point °F.		Below 100° F.		
Specific heat	0·189	0·218	0·194	0·187

ELECTRICAL PROPERTIES. COATED SHEET (SINGLE PLY)

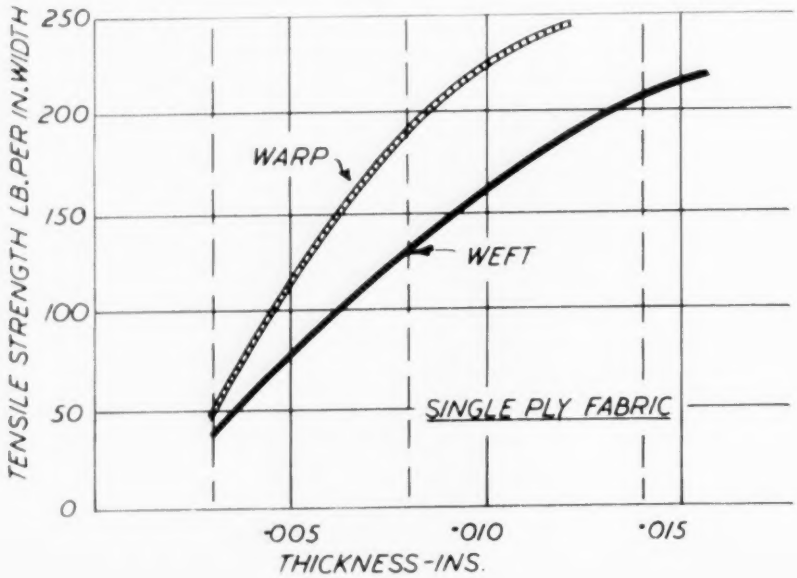
	Thickness (in.)				
	.003	.005	.008	.010	.014
Volume resistivity ohm-cm.	5×10^{11}	5×10^{11}	5×10^{11}	5×10^{11}	5×10^{11}
Insulation resistance ohms	10^{8}	10^{8}	10^{8}	10^{8}	10^{8}
Dielectric constant	2·8	2·9	3·0	3·0	3·3
Surface arc Resistance (sec.)	500	500	250	240	240

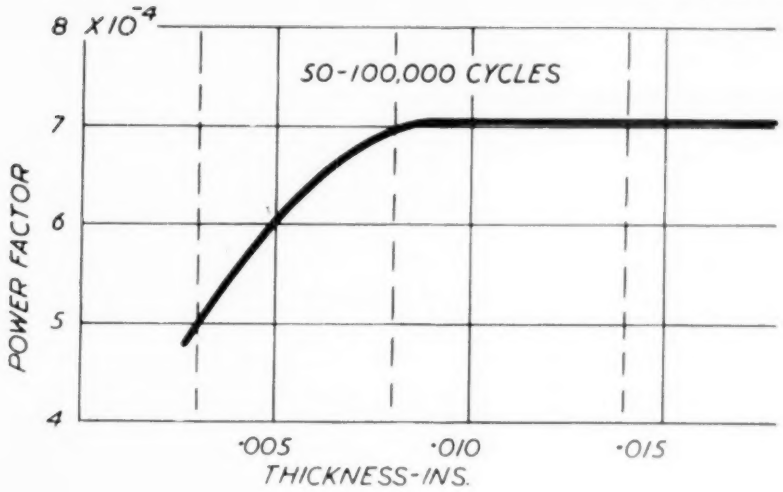


of panel boards or flat structural panels.

Coated glass fabrics have also been suggested as an ideal material for conveyor belting where the anti-adhesive properties of the material, and extreme resistance to corrosion make for economic operation and a long life. The material, too, is essentially a "clean" one, and as such should have a wide appeal to the food manufacturing industries.

Extensive tests have shown that polytetrafluoroethylene is completely inert as far as contact with foodstuffs is concerned and has no toxic effect even if taken internally. There is, however, a maximum working tem-





perature of about 350° for polytetrafluoroethylene used in contact with foodstuffs. At approximately 50° F. above this recommended maximum, fluorine gas is given off in small quantities. Gassing accelerates slowly with increasing temperatures until at 600° F. and above the quantities evolved may be appreciable. Above 750° F., polytetrafluoroethylene begins to decompose slowly.

Since the maximum continuous service temperatures for polytetrafluoroethylene-coated glass fabrics permissible in certain applications is in the region where gassing occurs, adequate ventilation must be provided for these applications.

This gaseous emission can be toxic, if confined.

Polytetrafluoroethylene-coated glass fabrics and laminates are a patented product of E. I. du Pont de Nemours of America and are marketed under the trade name of "Teflon." This brand name is also used for the application of polytetrafluoroethylene in paints, primers, enamels, and so on. Some of the chief properties of "Teflon" fabrics and laminated sheet are summarised in the tables and accompanying diagrams.

Radioisotopes in Ceramic and Glass Manufacture

(SPECIALLY CONTRIBUTED)

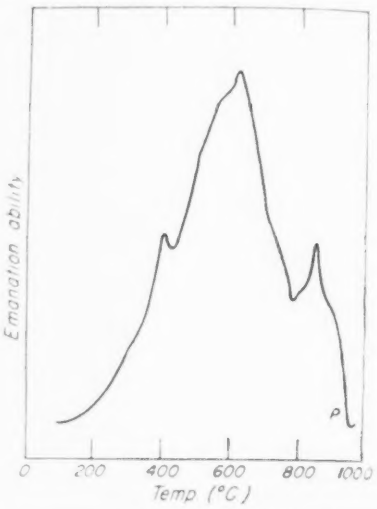
THE ceramic and glass industry has now available a new research technique using isotopes, which make it possible to solve various problems during manufacture, which hitherto have not yielded to experiments. To utilise radiation phenomena in analysing properties of porcelain, pottery, glass, refractories and other materials opens up new possibilities for improvement of quality. As far back as in 1944 samples of powdered glass have been treated with a radioactive solution, then heated, and the effect of radiation observed in a ionisation chamber. Thus fusing and sintering properties of powdered glass could be observed. The accompanying illustration shows an emanation for studying the fusion of glass batch materials. It is a temperature curve, obtained by plotting emanation intensities against temperature.

The Science of Isotope Application

Industrial application of radioactivity is based on the ability of radioactive rays to penetrate opaque materials where light cannot. Isotopes (radioactive materials) may be called "industrial eyes." They see where human eyes or conventional photographic instruments cannot see. The simplest and oldest application of this is X-ray. But X-ray has the well-known limitation that it lacks penetration. It can see through skin and flesh, but not thick steel. Isotopes can see through great thicknesses of steel and other industrial materials. This application of radioactivity is known as industrial radiography.

X-rays can see through only thin metals. Radium—a natural isotope—provides a source of rays that can penetrate much further. But radium is expensive and takes an impractical long time to penetrate some thick materials. Much better is isotope "cobalt 60," which is less penetrating than radium but costs much less and acts more quickly. Use of isotope "cobalt 60" is not exclusive and specialists have developed the use of other isotopes which are superior for certain jobs. Chief of these is isotope "iridium 192" for radiographing welds and medium to light castings. Another is the isotope "sodium 24" which is to be used for the first time at the Aluminium Co. of Canada's Kingston plant.

An isotope is a chemical element (substance) which has been bathed in radioactivity in an atomic pile, and retains radio-active properties which it then proceeds to emit until expended. The power of radioactive rays is measured in curies. The number of curies determines the penetration or "punch." Punch is determined by the type of radiation (e.g., electron or gamma ray); the energy



Temperature curve obtained by plotting emanation intensities against temperature

of the radiation and the power of the isotope is measured in curies. The expenditure of an isotope's radioactivity is measured in terms of its "half-life," that is, the amount of time until half the radioactivity is exhausted. This length of time will be taken to expend half of the remaining half (or one quarter) and again to expend half the remainder *ad infinitum*.

In applying radioactivity to industrial use, it is well to consider three factors to determine the use of isotopes.

1. The "punch" or penetration of the isotope.

2. The length of its "half-life." It may be too short to be practical; take too long to be economical (the "cooking" process might take too long in the atomic pile; a long half-life requires long "cooling" time).

3. Availability of the isotope. (Isotope "sodium 24," for example, can be made by taking ordinary table salt—(sodium chloride)—and bathing it in Chalk River atomic pile.) There are about 60 to 70 useful isotopes, but isotope engineers are using eight to ten of them.

Radioactive materials emit electrons and gamma rays. Atomic piles emit electrons, gamma rays and neutrons. The neutrons are not only lethal but induce radioactivity in things they contact, thus they contaminate metals, earth, water, etc., by making them radioactive. Gamma rays are also lethal but are not retained by the media they contact or pass through. Electrons (or beta rays) are not lethal but can burn the skin. Isotopes used industrially rely on gamma or beta rays for their penetration; they cannot shoot off neutrons.

Radioisotopes from nuclear reaction are today available in a great variety from the Harwell Research Establishment in England, and in more powerful concentration from the Canadian radio-pile in Chalk River, Ontario. By using isotopic tracer technique, minute particles can be admixed to ceramics during manufacture, which isotopes react on a photo-plate, and allow to determine diffusion co-efficients of various constituents of

ceramics, enamels and tiles. Of great interest to the ceramic engineer is resistance of refractory material against corrosion, for example from molten glass. By applying a specimen of a new ceramic material to thermal neutrons produced in a nuclear reactor at Oak Ridge in U.S.A., the corrosive resistance could be established, without using a pilot plant. Radioceramics as a branch line of radio chemistry can be expected to disclose molecular movements and arrangements of various materials, thus helping industrial research in problems which are of utmost importance during manufacture.

Bibliography.

Harwell, The British Atomic Energy Research Establishment. Publ.: H.M. Stationery Office, London, 1952.

Canadian Isotope Newsletters. Publ.: Isotope Products Ltd., Oakville, Ont., Canada.

Radioisotopes Solve Glass Problems. Publ.: Ceramic Industry Chicago, Nov., 1952.

PACKAGED BRICKS

A New Approach to Handling

WHILE the normal practice in carrying common clay bricks has been, and still is, to send in bulk, loose, there has been a steady expansion in the use of packaging in some form or other for more valuable refractory bricks. Over the past ten years this policy has been expanded in the refractories industry, located in the centre of Scotland. Regular deliveries of high grade refractory bricks are shipped from the main Scottish ports to virtually every part of the world and many are packaged in one form of container or another. It is of particular interest that recently there has been a limited demand for a paper board container with corrugated divisions.

Let it be said immediately that this is as yet a limited form of packaging; the major flow has been and still is carried in wooden crates. But the mere fact that a few buyers have found it preferable to pack in board and have specified the type of container required indicates that there is scope in this field for some study of the market.

A brief mention of the industry itself, to ensure proper appreciation of the problems; refractory bricks are used extensively in combustion engineering practice to line furnaces or other vessels where high temperatures are involved. Any break in the surface of the brick offers scope for disintegration, and involves patching or other treatment, which may assist but not make the brick equal to an undamaged brick. Hence the need for packaging in this particular section of the ceramic industry.

Practice for many years has been to ship in timber slatted crates, with straw protection, very much as was the case in the china and glass industry. By and large that method of packaging has proved extremely satisfactory and fast. From the viewpoint of the manufacturer there is much to be said for timber containers, strawfilled, in that these allow much faster handling of the product than by alternative methods. The timber crate varies in size according to a weight to be carried, specific instructions and the type of contents. There is a very wide range of bricks involved, with a multiplicity of shaping, according to function. That again is a reason for use of straw filled crates since these lend themselves more readily to varying shapes than does a standard shape paper board container. These comments emphasise the tendency to maintain a traditional form of handling, which is fast, versatile and satisfactory. The timber crate also has a re-use value which is an added factor in the economics of the situation.

Having stated the case for timber it is a fact that a few customers have specified and received paper board containers as well as timber crates. These have been used in the shipment of standard type bricks to the Dutch West Indies. Such containers are of paper board with corrugated separation between each of the eight bricks carried. The pack measures some 11 in. by 9½ in. by 9½ in., completed with ¾ in. strapping, making a compact and highly protective pack. It is stressed by the brickmakers that such packs can be used only for standard-shaped bricks allowing easy nesting within the pack; it is also stressed by the brickmakers that such packs can be used only for standard-shaped bricks allowing easy nesting within the pack; it is also stressed that the time involved in packing a given number of bricks in such board packs is considerably greater

than that involved in packing the same number of bricks in a wooden crate among straw. Nevertheless the fact persists that for some buyers at least the board container has merits which encourages them to insist on its use.

It should be made clear here that the question of packs is one which depends to a considerable extent on the buyer; the brickmaker has his own ideas as to handling methods and his own data on the economics of various methods in actual material costing and in handling time. But whatever his own views he bows to the buyer and delivers the product in the container which the buyer specifies. It might be added here that bricks are still sent loose, in bulk, on occasions, so that there is no hard and fast ruling.

As far as the transporter is concerned there is no question as to the superiority of packaged consignments. Handling labour is now extremely costly. Pilfering is a factor which cannot be ignored, while damage claims are also an important point which encourages the trend to packaged products.

If labour costs tend to rise or even remain stable at present levels, the handling of loose individual cargoes such as bricks becomes uneconomic and costly; the breakage factor is equally important. For all these reasons, the transporter prefers a packed consignment to a bulk consignment. There is evidence too that the consignee supports this view, as witness the steady increase in the delivery of packaged bricks.

But there is equal evidence that packaged bricks demand a new approach to the whole question of continuous handling. If board firms are to take a bigger share of this market they will require to devise systems rather than containers, and to demonstrate that these systems are cheaper to work than hand methods using alternative containers. It will be necessary too to devise packs which accommodate varying types of bricks, easily, quickly and economically. A start has been made to the use of board in this field, but one feels that there is much to be done in organising its application before it can oust timber as the basic material for carriage.

Against that there is the support given by buyers who now find board containers a safe, efficient and economic method.

Crucible Furnaces. We have received from The Morgan Crucible Co. Ltd., Battersea Church Road, London, S.W.11, three illustrated leaflets dealing with their lift-out, bale-out and tilting crucible furnaces.

THE BRITISH CERAMIC SOCIETY

WE give below abstracts of the two papers appearing in the Transactions of the British Ceramic Society, for January, 1953.

Further Investigations on the Sintering of Oxides. by P. W. Clark, H. J. Cannon, and J. White. There is as yet no general agreement regarding the mechanism of the flow occurring during sintering. Possible mechanisms are viscous flow, plastic flow involving the movement of dislocations, and surface or volume diffusion involving the movement of lattice vacancies. At one time it was thought that the latter process would involve migration of the vacancies to the outside of the compact and that it would, therefore, be much too slow a process to account for observed shrinkage rates, but it is now believed that, in the case of metals at least, vacancies can be eliminated within the metal at grain boundaries, dislocations, and mosaic boundaries. It has also been shown that movement of vacancies under stress in polycrystalline metals may give rise to a viscous type of flow.

Attempts to account for the observed shrinkage-time-temperature relationships of actual compacts have been made on a phenomenological basis by Mackenzie and Shuttleworth and by Clark and White; both developed their treatments for the cases of viscous flow and plastic flow. In the present investigation isothermal shrinkage curves were determined at various temperatures for magnesia, lime, ferric oxide, a calcined natural dolomite, magnesia with the addition of a eutectic melting at 1,345° C., and metallic copper, the latter being used both in the form of rounded particles and angular particles. Attempts to fit the shrinkage curves were made using both the Mackenzie-Shuttleworth and the Clark-White formulæ. In all cases a good fit was obtained on the assumption that plastic flow with a temperature-dependent yield-point was occurring. The first-mentioned formula gave the better fit at high degrees of shrinkage and the latter at low degrees of shrinkage. Energies of activation evaluated by the two methods were in good agreement.

In the case of copper the indicated energy of activation was very much lower than the energy of activation for self-diffusion, suggesting that a plastic flow mechanism rather than a diffusion mechanism might be involved. Yield stresses and viscosities at infinite rate of shear calculated for the two samples of copper by use of the Mackenzie-Shuttleworth equations were in good agreement, as were values calculated for two samples of magnesia of different particle size.

A method of evaluating energies of activation from shrinkage-time curves which does not involve the assumption of any specific model is also described. As is well known, where a reaction is controlled by a single temperature-dependent rate constant, the energy of activation can be obtained from the slope of the $\log t_x$ against $1/T$ k plots, where t_x is the time to a given degree of reaction x. In the case of glasses this relation has been found to hold at all degress of sintering. This is consistent with a viscous flow of mechanism. In the case of crystalline materials, including metallic copper, the relationship is not generally valid. This is consistent with the view that at least two temperature-dependent variables control the sintering behaviour. By extrapolating to zero shrinkage when the capillary forces causing sintering are very large, however, it is found that a unique value of the energy of activation, which agrees well with that obtained by use of the sintering equations, is obtained. The dependence of the energy of activation and the A factor in the Arrhenius equation on the chemical nature of ionic solids is discussed.

Experiments which throw some light on the nature of the cohesive forces in as-pressed oxide compacts are also described. In the case of Al_2O_3 and MgO it was found that a sudden increase in strength occurs at temperatures which correspond apparently to the destruction of adsorbed moisture films on the surfaces of the particles, and to the replacement of hydrogen or hydroxyl bonding between particles by primary ionic bonds. This occurs at temperatures well below those at which sintering proper with densification sets in.

The Quantitative Determination of Some Minerals in Ceramic Materials by

Thermal Means, by R. W. Grimshaw and A. L. Roberts. The method of differential thermal analysis has been applied to the quantitative determination of certain minerals in ceramic materials. Most minerals exhibiting physical or chemical changes on being heated can be accurately estimated by this rapid method. Notible exceptions are the silica minerals, cristobalite and tridymite.

The rate of temperature rise influences the quantitative estimation of minerals to a great extent and accurate results can only be secured by ensuring a reproducible rate.

Results are also influenced by the thermal nature of the sample, and changes in the specific heat or thermal diffussivity can effect the thermal curve and render analysis difficult. To overcome this, the authors find that very reproducible and accurate results can be obtained by diluting all samples with some standard, thermally inert, material before testing. A mixture of 25 per cent. sample with 75 per cent. calcined alumina has been most effective.

The method has been used for estimating clay minerals such as kaolinite, halloysite, livesite, and montmorillonite, for the naturally occurring carbonates calcite and magnesite, and for quartz, the hydrates of alumina, iron oxide, etc.

CARRIER ENGINEERING CO.

WE are informed that an agreement has been concluded between the Schweitzer Equipment Co. of Cleveland, Ohio, designers and manufacturers of the well-known automatic machinery for the ceramic industry, and Carrier Engineering Co. Ltd., of London, such that the latter concern will manufacture Schweitzer machinery in England and will also be responsible for sales and servicing, both in the British Isles and abroad.

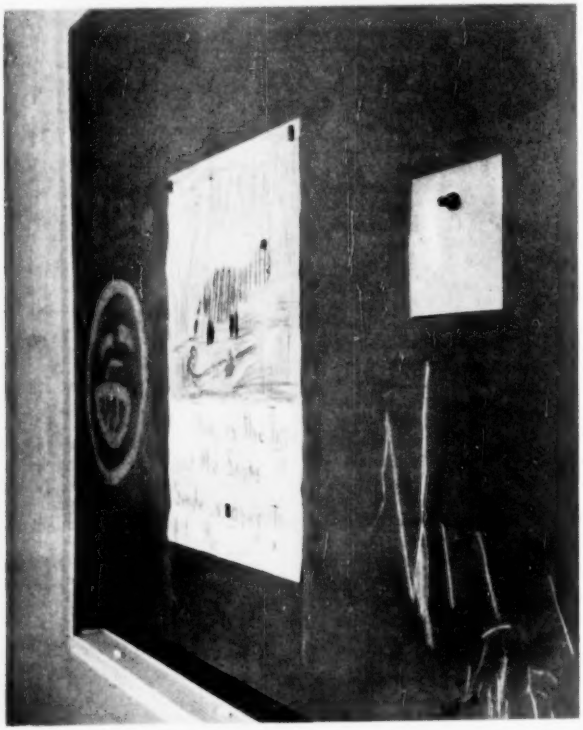
The complete line of Schweitzer ceramic machinery will be handled by Carrier Engineering Co., who have had extensive experience of paint finishing equipment, such as applies finishes to motor-cars, refrigerator cabinets, and a wide variety of other products, such equipment, generally, automatically applying the coating. The Carrier Co. are already building certain finishing equipment to Schweitzer Patents, and it is because of this association that they have now entered the ceramic field.

Carrier are, of course, also recognised as one of the leading companies engaged in air conditioning, refrigeration, heating, ventilating and other industries and, generally, have some very large and notable installations to their credit.

THE FUTURE OF VITREOUS ENAMEL

THE enamelling industry derives from an ancient art, yet it is essentially a young, growing industry which has barely scratched the surface as far as its potential goes. The American Ferro Enamel Co. found that possibilities that are open to it in the line of developed design requiring one or several of its very practical properties, are fascinating.

Uses for vitreous enamel are varied and boundless. It is now being utilised in architecture where steel as a wall panel has been a negligible factor and is now becoming, in the form of enamelled steel, an increasingly popular curtain wall material. Although there is no such thing as a non-chippable vitreous enamel, it is now considered a very rugged material by engineers, architects, and commercial users. For instance, thread guides, which would be cut in half by the terrific friction of the racing thread, have a greatly extended life when coated with porcelain enamel. Hard steel will not stand up under the abuse of coal in a coal chute, but a vitreous enamel coating extends its life many times. Vitreous enamel can combine the beauty and practicability of metal shaping with a permanent, heat-resistant, acid-resistant, salt water-resistant



An enamelled steel chalk board. The modern equivalent of the school blackboard

finish. It is also corrosive-resistant, abrasive-resistant, an electrical insulator, probably the easiest material for radioactive decontamination, extremely flexible as to texture and colour, and reflectant.

Formerly thought of only as a decoration, vitreous enamel is now being used also in structural parts. The Otis Elevator Co. in the U.S., for instance, has discovered its practicability for coating the step risers of escalators. Stainless steel mars, scratches and becomes streaky when thousands of toes bump, scrape and rub on an escalator step riser. A coating of porcelain enamel so solves the problem that Otis Elevator today utilises this finish exclusively in their escalators.

The Bettinger Corporation of Massachusetts, a pioneer in developing new uses for vitreous enamel, has given the task to its research engineers to experiment with vitreous enamel for many new fields of industrial applications. They are extending, for instance, the life of tanks, pipes and fittings which are attacked by corrosive materials or electrolytic action. Textile machines, leather product equipment, etc., are now employing vitreous enamel. Artistically, for sculptural work in design and decoration, it is also making progress. Architectural uses are being developed and include both extensive interior and exterior uses. Bettinger has developed a wide angle reflectorised vitreous enamel which reflects up to 500 ft. and is rated highly by safety engineers; and a chalkboard to replace the old style blackboard. It is available in a variety of colours, has excellent surface properties and is easily cleaned.

Vitreous enamel is no longer difficult to work with. In fact, it has become tremendously versatile and is adaptable to various grades, stages and qualities of sheet metals. Ideally, however, "enamelling iron" and soft grey iron castings are preferred. Cold rolled steel can also be used as a base, and even, in some instances, hot rolled. Recent developments have indicated that commercial practicability may be attained in enamelling on stainless steel, and such high temperature alloys

as Inconel and Monel. Enamelling is also successful for some purposes on aluminium. So-called artistic metals, such as copper and silver, can also become bases for enamelling. Bettinger engineers have successfully enamelled on some of the particularly special alloys such as Kovar. In addition to sheet metals, cast metals, such as cast iron and cast steel are suitable bases for enamelling, although the technique is different, both in the preparation of the metal and in the firing cycle.

A real challenge exists for modern ceramists to develop all the possibilities inherent in the almost fabulous part-old, part-new process of vitreous enamelling. Forward thinking can develop this industry to the benefit of industry as a whole as well as the consuming public.

SOUTH AFRICAN NEWS

Bricks from Mine Dump Sand

SAND, from the numerous gold mine dumps in and around Johannesburg, previously regarded as useless and virtually impossible to dispose of, is at present being used for the manufacture of sand-lime bricks. Although only a recent development in South Africa, the sand-lime bricks produced in Holland since 1933 have comprised more than a quarter of that country's total output of bricks.

An important advantage of the bricks, due to their being machine moulded, is that they are remarkably uniform in shape and size. Their light colour and good light reflecting properties give them a pleasing appearance and they show no serious tendency to efflorescence. It is anticipated that the demand for this type of brick will develop as its characteristics become more widely known.

To assist manufacturers of sand-lime bricks to produce a quality product, the Bureau of Standards has recently issued a specification for these bricks. Based largely on the results of tests conducted in the Bureau's civil engineering laboratories, the specification covers two common grades of brick and a special grade for external facing work. Dimensional and physical requirements, sampling methods and certain performance tests are described.

High Tension Insulators

An agreement has been signed between the Westinghouse organisation in the United States and the South African Glazing Co. (Pty.) Ltd., of Boksburg, for the manufacture under licence of high tension insulators in South Africa.

An automatic electrically-operated kiln has been installed in the works at Boksburg, and output of the insulators will be considerably expanded when additional plant and testing equipment, now on order from Britain, is installed. Included in the equipment is a high-tension testing transformer capable of testing insulators up to 250,000 volts.

The South African Glazing Co., which began operations in 1945, is now making a normal range of twenty-seven insulators in addition to other special insulators and ceramics to specification.

Port Elizabeth Bricks.

A brickmaking plant is to be set up on the outskirts of the city by the Port Elizabeth Municipality for the manufacture of its own bricks.

Samples of the clay available in the vicinity have been tested in the Transvaal, and reports are favourable that an excellent facing brick, lending itself to quick drying, could be made.

On a proposed Municipal building programme of 100 houses per month, it is estimated that an annual saving of £22,080 could be effected.

New Safety Glass

The Shatterprufe Safety Glass Co. Ltd., of Port Elizabeth, is manufacturing a new type of safety glass which is claimed to effect a major reduction of harmful glare light.

Glareprufe glass is available in flat and bent sheets and acts as a barrier to a high percentage of the harmful ultra-violet and infra-red radiation.

Glass Fibre Manufacture

The first glass fibre to be manufactured in South Africa is now being made by the Glass Development Corporation (Pty.) Ltd., of Johannesburg. Up till now the Union has had to import its supplies of glass fibre.

Raw materials used in the manufacture of the fibre comprise cullet, bought from Johannesburg plate glass works, sand which is obtained locally, and soda from East Africa. The furnace, built of locally made refractories, is of a continuous type, and is fed, as

required, with three different fuels.

The extensive use of glass wool up to the present has been limited by the availability of supplies. The establishment of the Glass Development Corporation in Johannesburg removes one of the most serious obstacles to a more extensive application of glass wool by local industry.

The present output of the company is considered ample for the country's needs, but additional plants will be erected as local industrialists begin to take advantage of the new material. It is anticipated that the material will be used for the construction of inexpensive native housing.

In addition to supplying this useful material to the South African market, the technical directors of the company have made available to interested industries the service of technical advice and collaboration which will ensure the most efficient and economic use of this glass fibre product. It should also do much to extend application of glass wool by South African engineering and industrial enterprise.

CERAMIC MATRIX USED TO CONTROL GROWTH OF CACTI AND SUCCULENT PLANTS

BY using, among other things, a special matrix based on a ceramic material a Dutch nursery at Gouda has succeeded in entirely controlling the growth of cacti and succulents, thereby avoiding customs restrictions which prohibit the importation of plants which are rooted in earth.

Among these cacti and succulents are some the growth of which had been arrested when the plant had reached a height of hardly one centimetre (less than half-an-inch).

After a short time the matrix becomes so hard that the plant will stand any transport. It is even possible to make buttonholes with living miniatures.

The only attention these dwarf plants require is the feeding of a few drops of water once a week or once a fortnight. Dishes and bowls of plants are made up in attractive colour schemes and can be supplied the size of a postage stamp filled with various plants.

Exports have already been made to Great Britain and the United States.

ABRASION AND ACID RESISTANCE OF VITREOUS ENAMELS

A REPORT has reached us of the work done by the Enamelled Metals Laboratory of the American National Bureau of Standards on behalf of American enamel manufacturers. It reveals interesting effects of acid pre-treatment of vitreous enamels on the acid resistance and abrasion resistance of the treated specimens. Although, say the Bureau, work is still proceeding, the results to date are sufficiently interesting to merit publication.

During revision of a specification, some tests were made with the object of comparing the relative effects of hydrochloric, citric and acetic acids on a range of enamels. Results showed that acetic acid (vinegar) is much less corrosive than citric or hydrochloric. A remarkable discovery, however, was that the comparatively minor visible attack of acetic acid strongly inhibited further attack when subsequently treated with citric acid, although the citric acid severely attacked untreated sections of the test specimen.

Pretreatment with acetic acid, in concentrations from 0·5 per cent. to 50 per cent., for periods of 5 min. and upwards were sufficient to protect against subsequent treatment with even 10 per cent. citric acid. Treatment with butyric acid for 15 min. had the same effect, but neither tartaric nor lactic acids were effective. A possible explanation put forward is that acetic and butyric acids both have the ability to preferentially leach alkalies from enamel surfaces leaving behind a silica-rich film which is resistant to further solution even in citric or stronger acids. With citric acid, the attack seems to go to a greater depth before build-up of this film is sufficient to inhibit further solution.

Abrasion Resistance

During the course of these experiments it was found that pretreatment for 15 min. in 10 per cent. citric acid markedly lowered the abrasion resistance of certain enamels having the Class A and B grade acid resistance as graded by the American Porcelain Enamel Institute's standard test. Moreover, on titanium-type enamels the effects were much more pronounced than on the antimony-type enamels. In neither case was the resistance to abrasion of Class AA enamels affected.

The effect of abrasion, to an extent comparable with that used when a stained spot is scoured, was sufficient to reduce the abrasion resistance rating from a good Class B to a poor Class C by the same test, modified to include the abrasion treatment. An equal amount of abrasion showed no visible effect on the untreated areas of the same specimen.

The researchers believe that these two effects are interrelated and that the silica-rich layer which results from preferential leaching of the alkali is less able to withstand abrasion than the original surface, in spite of the fact that it is more resistant to acid attack.

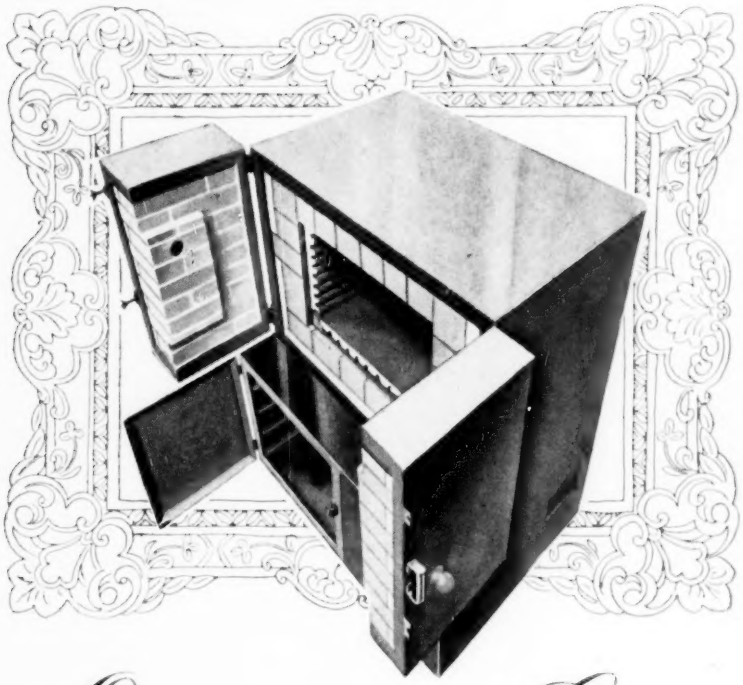
An inference to be drawn from the foregoing tests and results is that titanium-type enamels are specially sensitive to the above effects and, therefore, regular tests should be instituted in factories handling these enamels to ensure that the processing is carried out at optimum conditions. Additionally, the results would seem to indicate that it is desirable to include an abrasion test in the standard series of tests for regular productions of titanium-type enamel products.

SCOTTISH BUILDING CENTRE

AT the Fifteenth Annual General Meeting of the Scottish Building Centre, held in Glasgow on Thursday, 29th January, 1953, Colonel G. Gardner-McLean, who was in the Chair, stated that, during 1952, the many activities carried on in the Centre had been successfully maintained and developed.

The Chairman made the point that, in acting as a link between the manufacturer with a specialised product and a specialised knowledge, and the potential user who requires to be informed of both of these, the Centre has continued to offer a valuable service both to technical, trade people and general public.

Ministry of Works Economy Memoranda. The Ministry of Works has arranged with H.M. Stationery Office for recently published Economy Memoranda to be supplied at reduced prices to purchasers in bulk. This is to meet the convenience of large contractors who wish to distribute copies among their employees, or of organisations who wish to supply their members. Copies can be obtained (singly or in quantities) from P.O. Box 569, London, S.E.1, from any branch of H.M. Stationery Office or through booksellers.



Outstanding in its Class

Most electric pottery kilns look the same. It is, however, only constant experiment by the men who use them that enables perfection to be reached. Such is the Grafton Kiln. Developed over the years it is now outstanding in its class — that is why it costs a little more — that is why it is the choice of artist potters throughout the country. Complete specifications and full details of all models will be sent upon request.

THE GRAFTON KILN

THE APPLIED HEAT COMPANY LIMITED
ELECFURN WORKS, WATFORD BY-PASS, WATFORD, HERTS
Telephone: WATFORD 6094 *Telegrams:* GRAFTON, WATFORD

MR. P. ROBINSON

MR. PHILIP ROBINSON, who held a number of appointments with pottery firms between 1930 and 1937 has succeeded his father, the late Mr. H. T. Robinson as Chairman and Managing Director of Royal Crown Derby Porcelain Co. Ltd.

Mr. Robinson, who is a Derby Borough Magistrate, commenced his association with the pottery industry in 1930 when he joined Ridgways, Bedford Works, Hanley, as an office boy. A year later he took up designing and in 1932 he was appointed designer to the Royal Cauldon and Coalport Co. Ltd., Shelton, and twelve other factories.

In 1936 he joined the Universal Transfer Co. Ltd., at Burslem as designer, a year later undertaking similar duties with the Worcester Royal Porcelain Co. Ltd.

He joined the Royal Crown Derby as a designer in 1940 and at the same time became responsible for factory development. He was appointed Joint Managing Director the following year.

ADVERTISERS' INDEX

This is an Arrow Press Publication. Published Monthly.
Subscription Rate 25s. per annum.
Published by Arrow Press Ltd. at 157 Hagden Lane, Watford, Herts.
Telegrams: "Techpress, Watford." Telephone: Gadebrook 2308/9.

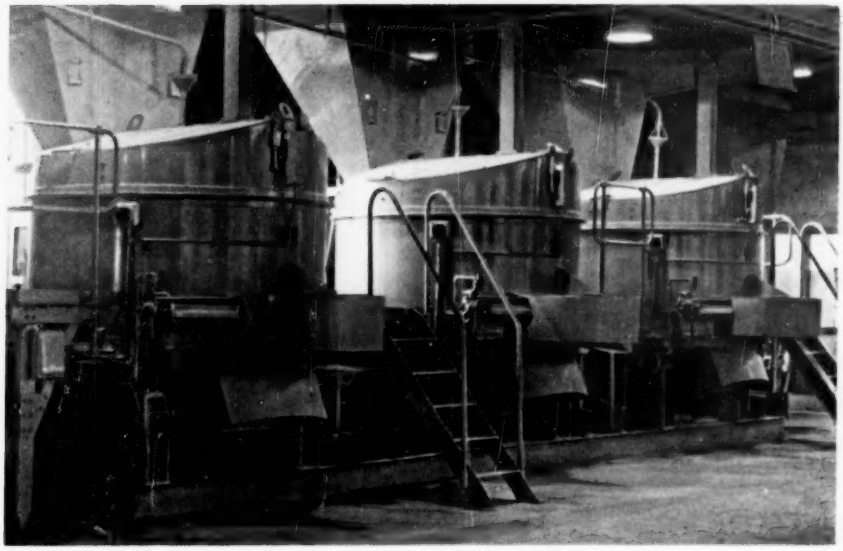
MADE AND PRINTED IN GREAT BRITAIN FOR THE PROPRIETORS, ARROW PRESS LTD., BY THE SIDNEY PRESS LIMITED, LONDON AND BEDFORD.

THE ANSWER TO *YOUR* MIXING PROBLEMS

AUGUST-SIMPSON MIX-MULLERS

We are steadily producing Mix-Mullers to all kinds of specialist requirements.

- In capacity ranges from 1 10 cu. ft. to over 20 cu. ft. per batch.
- In corrosion - resistant material.
- With different weights of mullers.
- With heating and cooling jackets.
- With vacuum attachment, dust cover, etc.
- Automatic loading and discharging devices.

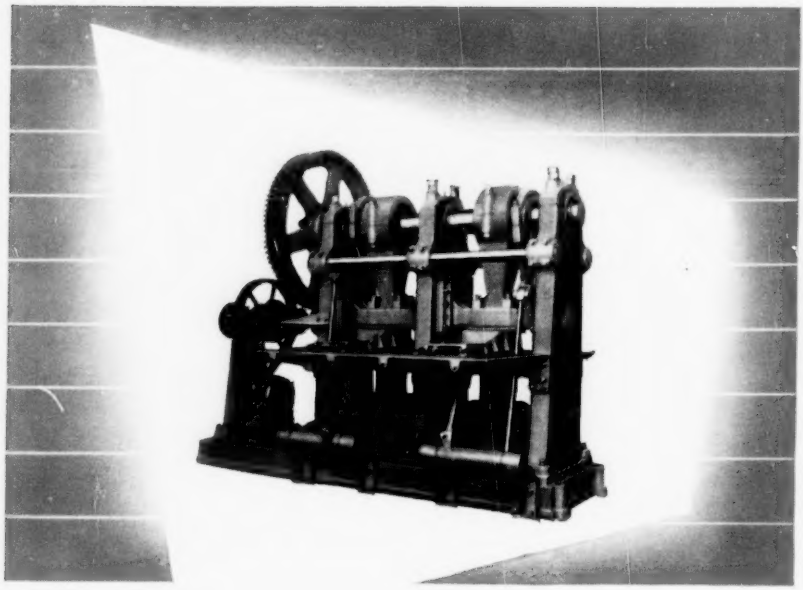


Battery of three No. 2 size August-Simpson Mix-Mullers.

Sole Licencees and Manufacturers of the Simpson Mix-Muller for British Empire (excluding Canada) and Continental Europe.

HALIFAX ENGLAND
Telephone: Halifax 61247/8/9
Telegrams: August, Halifax.

August's LIMITED



TILE MAKING MACHINERY

Many of the largest tile works in the country are raising standards of production with Bradley & Craven tile-making machinery. The stiff-plastic double die press illustrated presses and pierces 3,000 tiles an hour, while the single die press has an output of 1,500 tiles an hour. Both models are fitted with automatic feed motions, allowing one operator to keep both dies working to full capacity on the larger machine.

Whether you require information about a specific machine or advice on any problem relating to clayworking machinery, our experience is freely at your disposal.

B&C

BRADLEY & CRAVEN LTD

WAKEFIELD

Telephone: Wakefield 2244 5 *Telegrams: "Craven, Wakefield"*

dm BC 24